ELECTRICAL TIMES

THURSDAY,
JAN. 12, 1950
VOL. 117
NO. 3036
EST. 1891

6D

FUSE-LINKS
WHICH DISCRIMINATE

Certified by A.S.T.A. 250 A.C.4 and 440 A.C.4
(*To B.S.88 : 1947 and B.S.1361 : 1947*

BICC "E" TYPE FUSE-LINKS possess such a high degree of discrimination that they effectively eliminate premature operation, leaving sub-circuit fuse-links to deal with minor faults.

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15 amps, 30 amps, 45 amps, 60 amps at 250 v. A.C.4 and 440 v. A.C.4

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NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

Yes! Ask her. Ask your customer what she looks for in a cooker—in addition to the meat ration! B.N.E. asked Supply Authorities serving one and a quarter million consumers what they wanted, and incorporated their requirements in the Model C.49. As a result the specification includes more desirable features than have ever before been built into one cooker, not the least of them being the very attractive appearance . . . . . Send for full details now.

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The B.N.E. Model C.49

The Cooker that has everything

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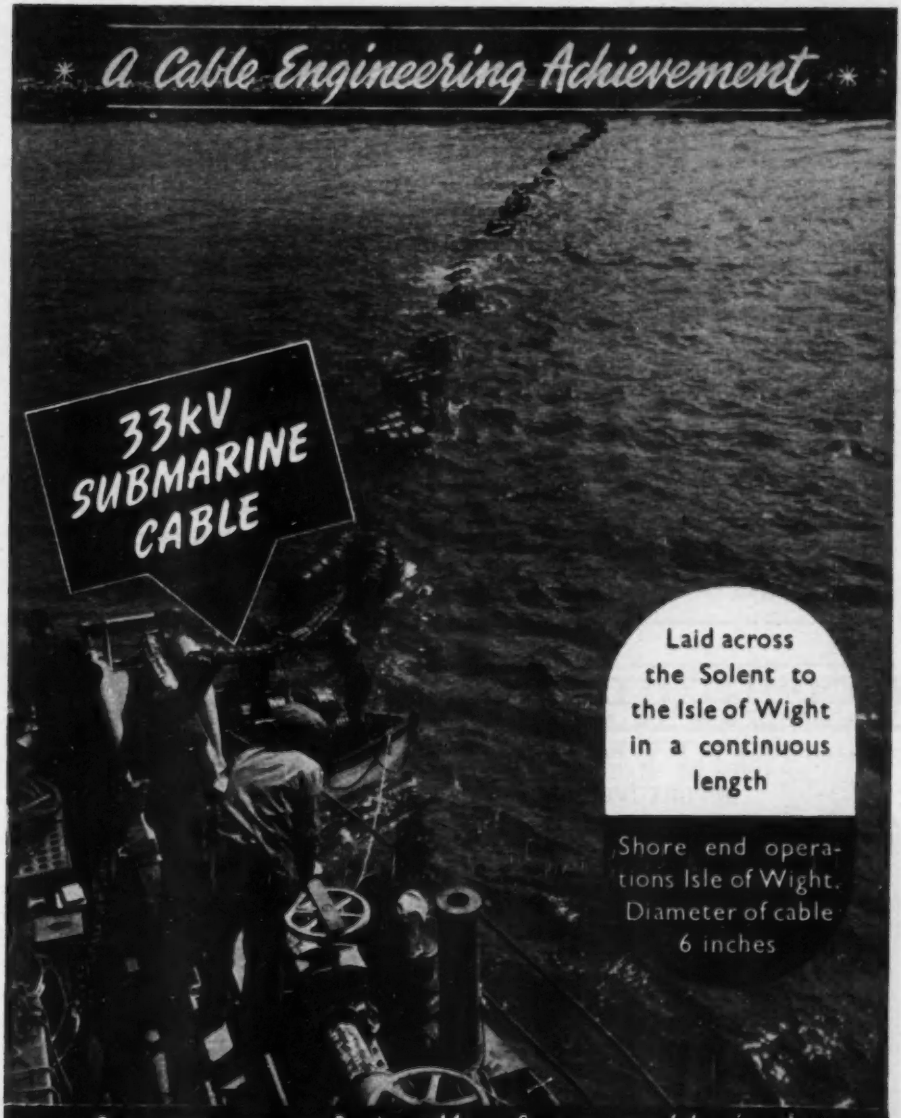
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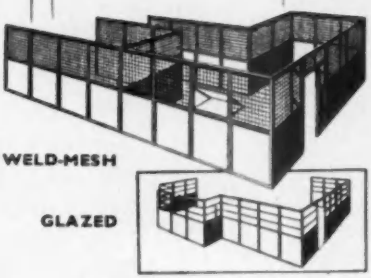

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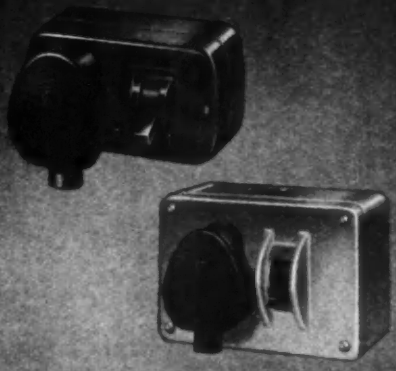

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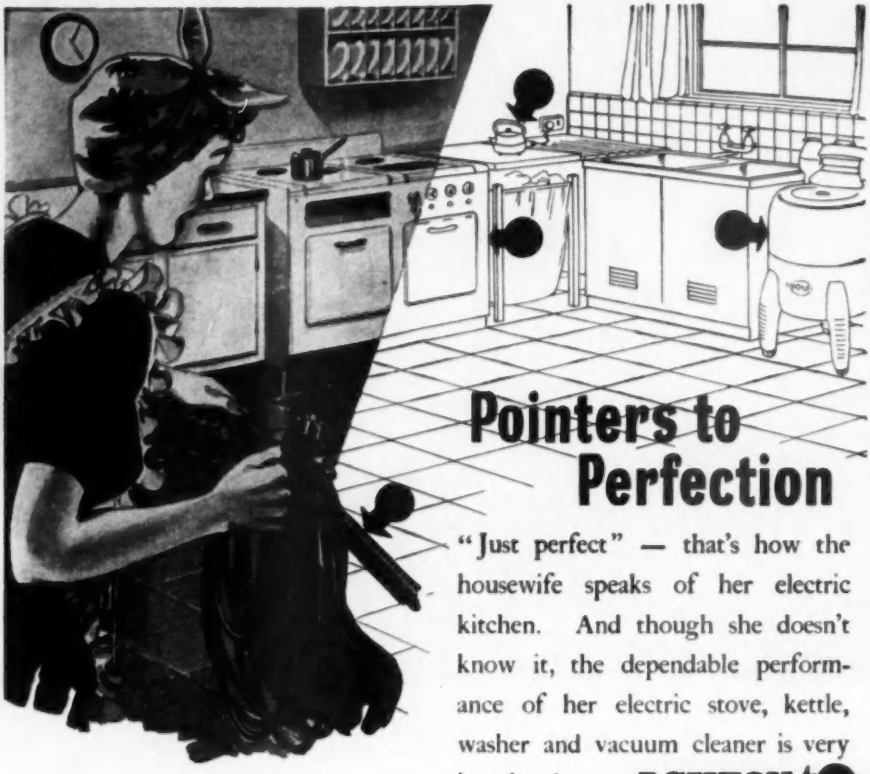

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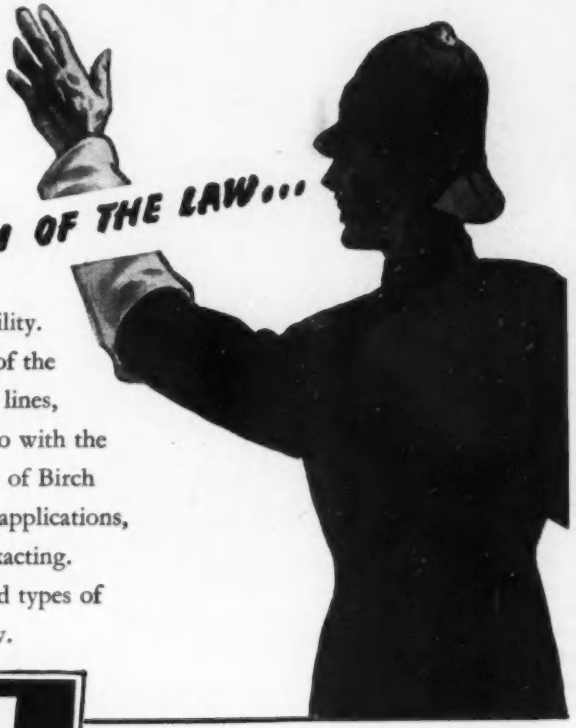

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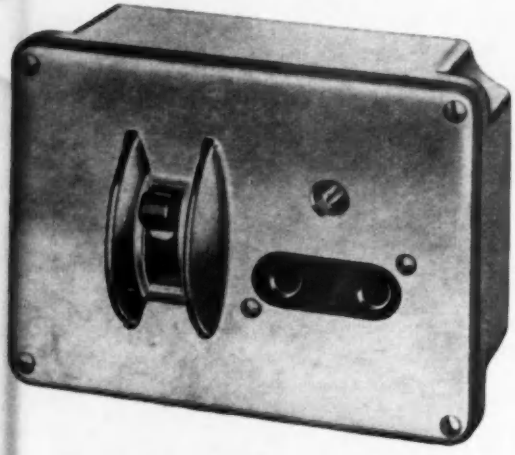

Interlocking Switchsocket-outlets are the only type which unquestionably ensure 100% safety. Switch can only be "On" provided plug is inserted and making full pin contact, and plug cannot be withdrawn unless switch is "Off."

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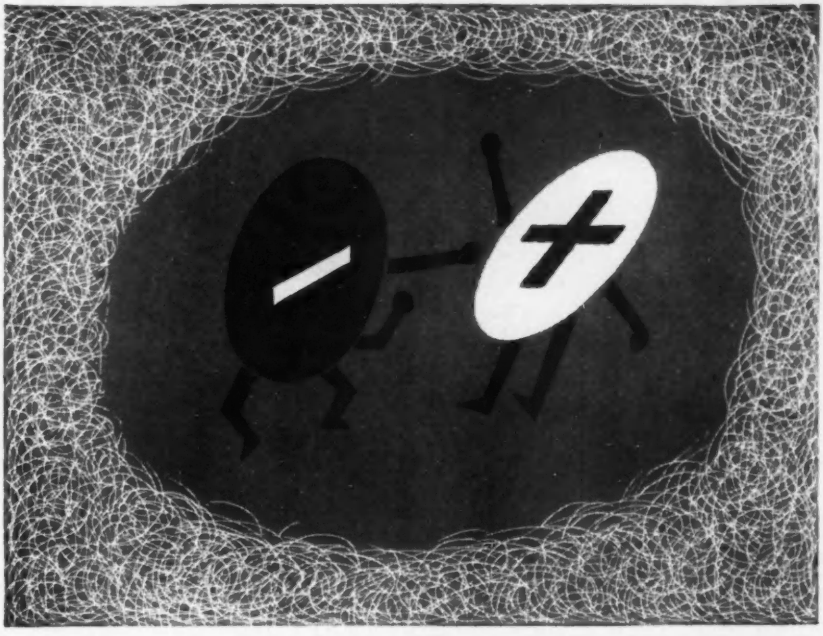

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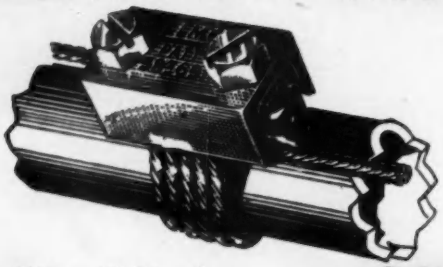

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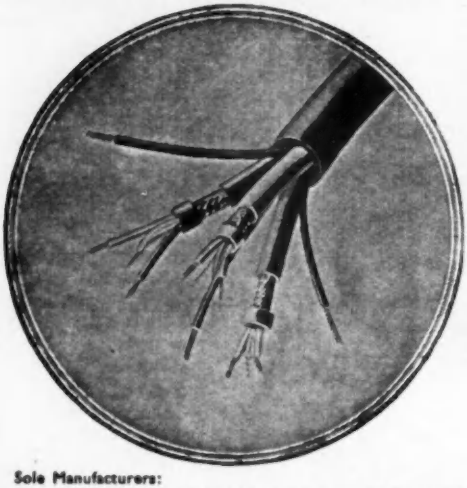

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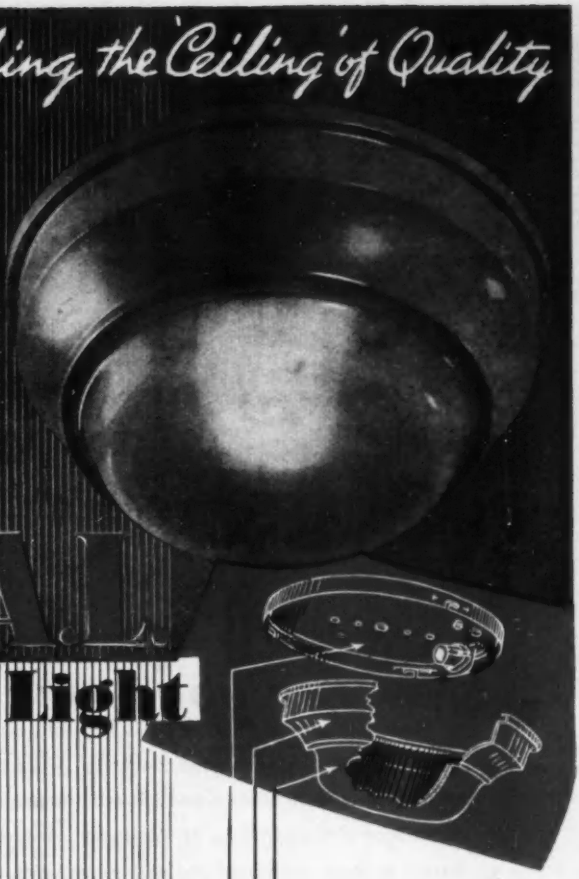

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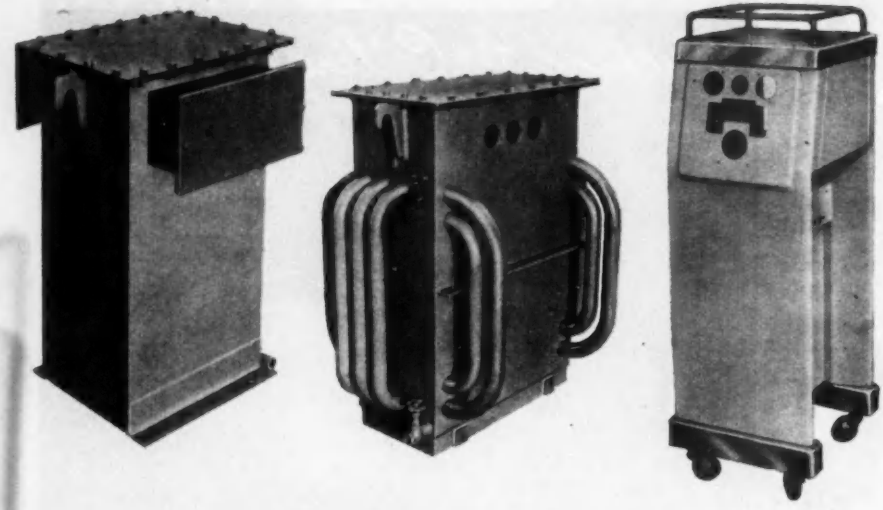

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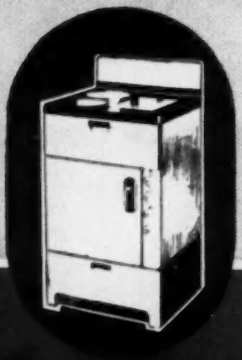

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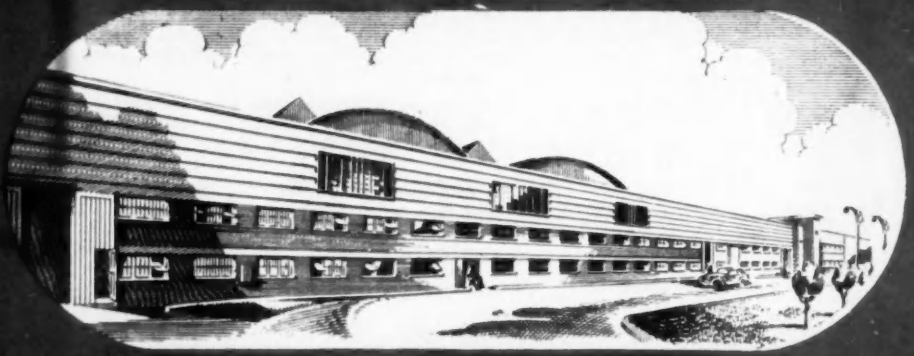

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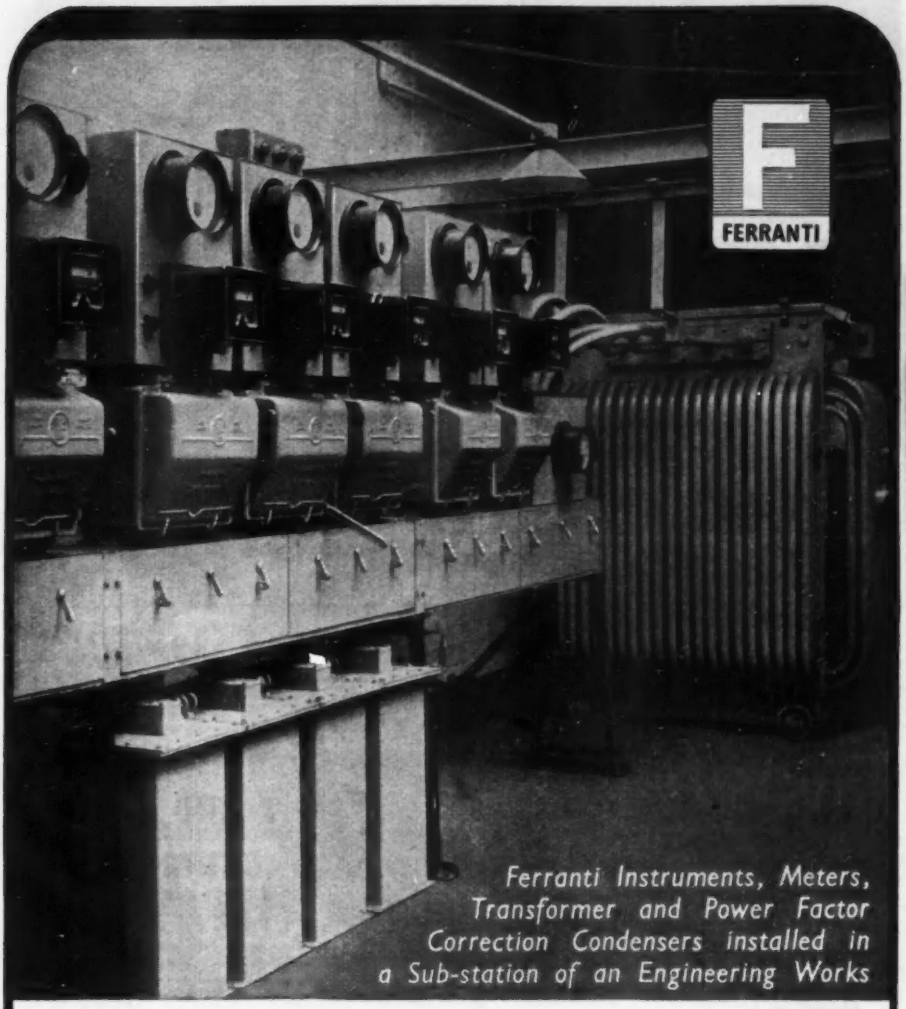

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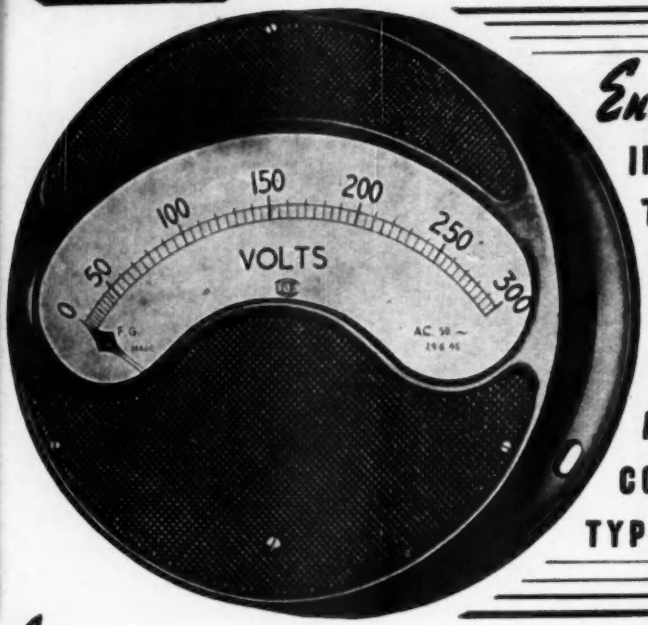

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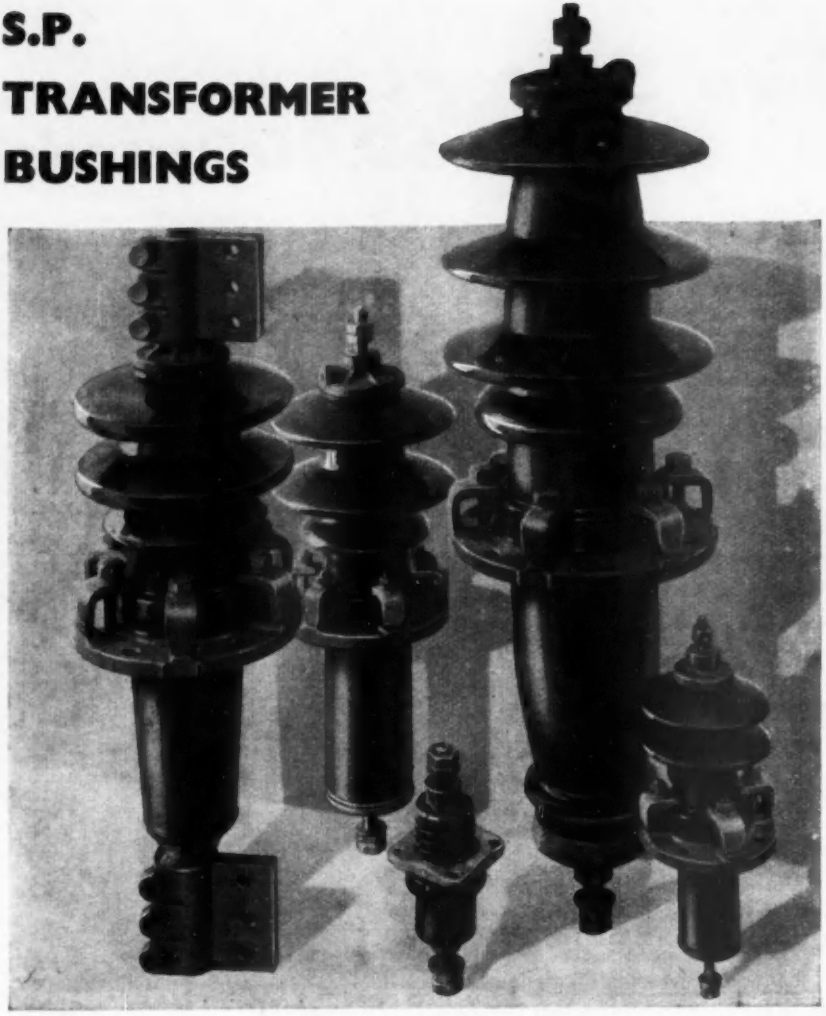

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your Hire Cooker

to be technically perfect

to be reliable

to look smart

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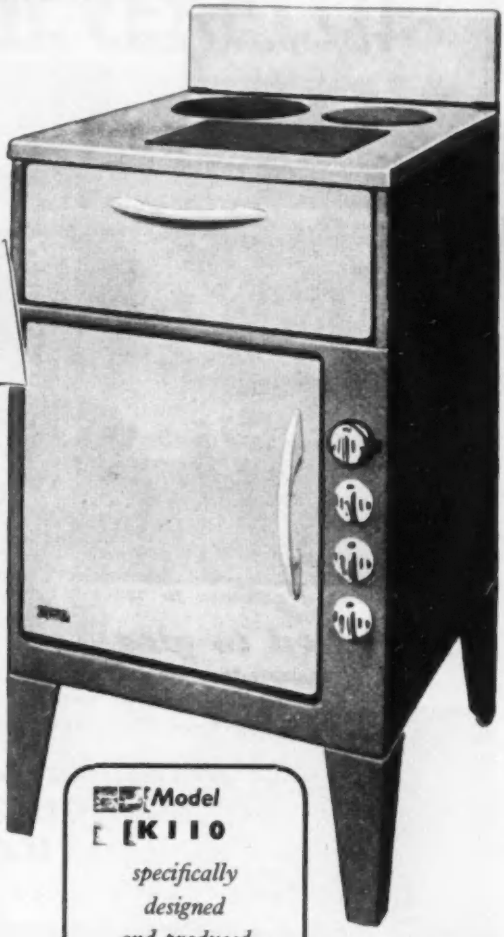

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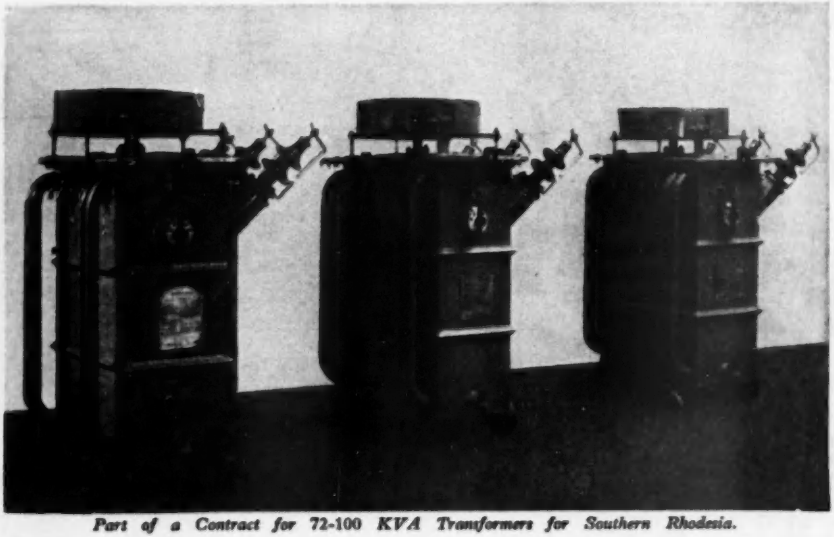

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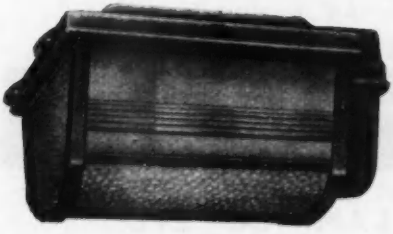

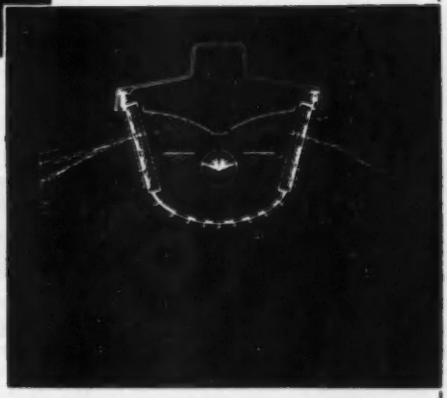

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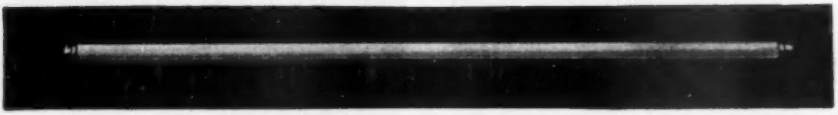

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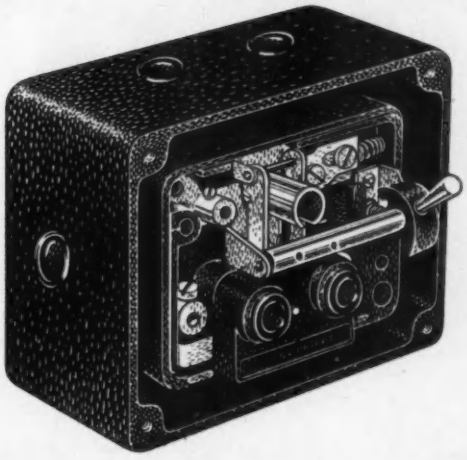

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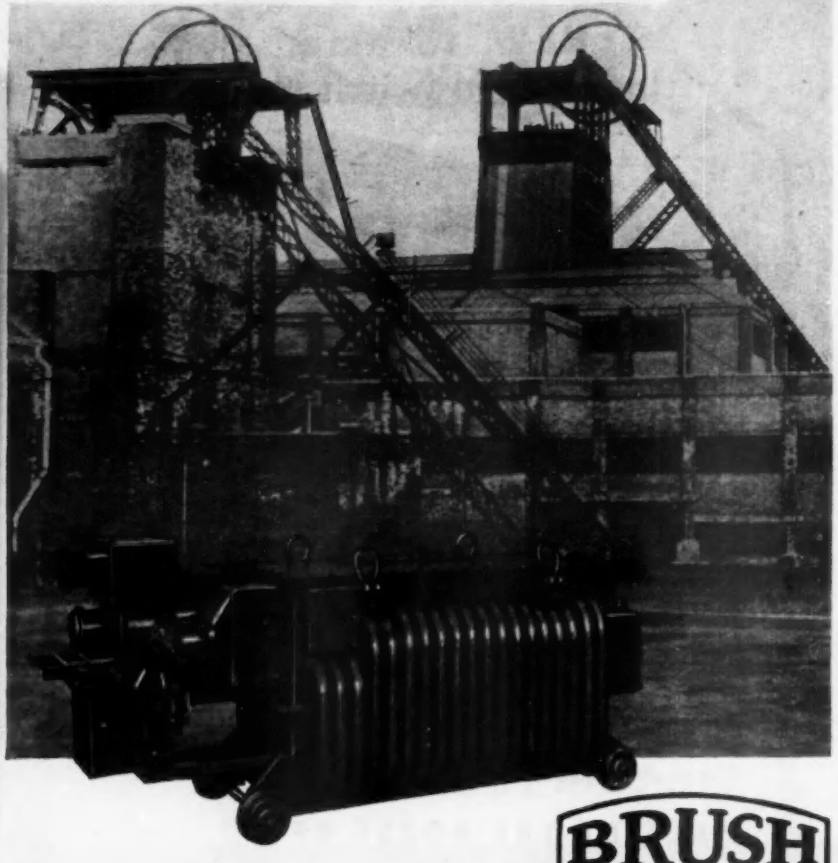

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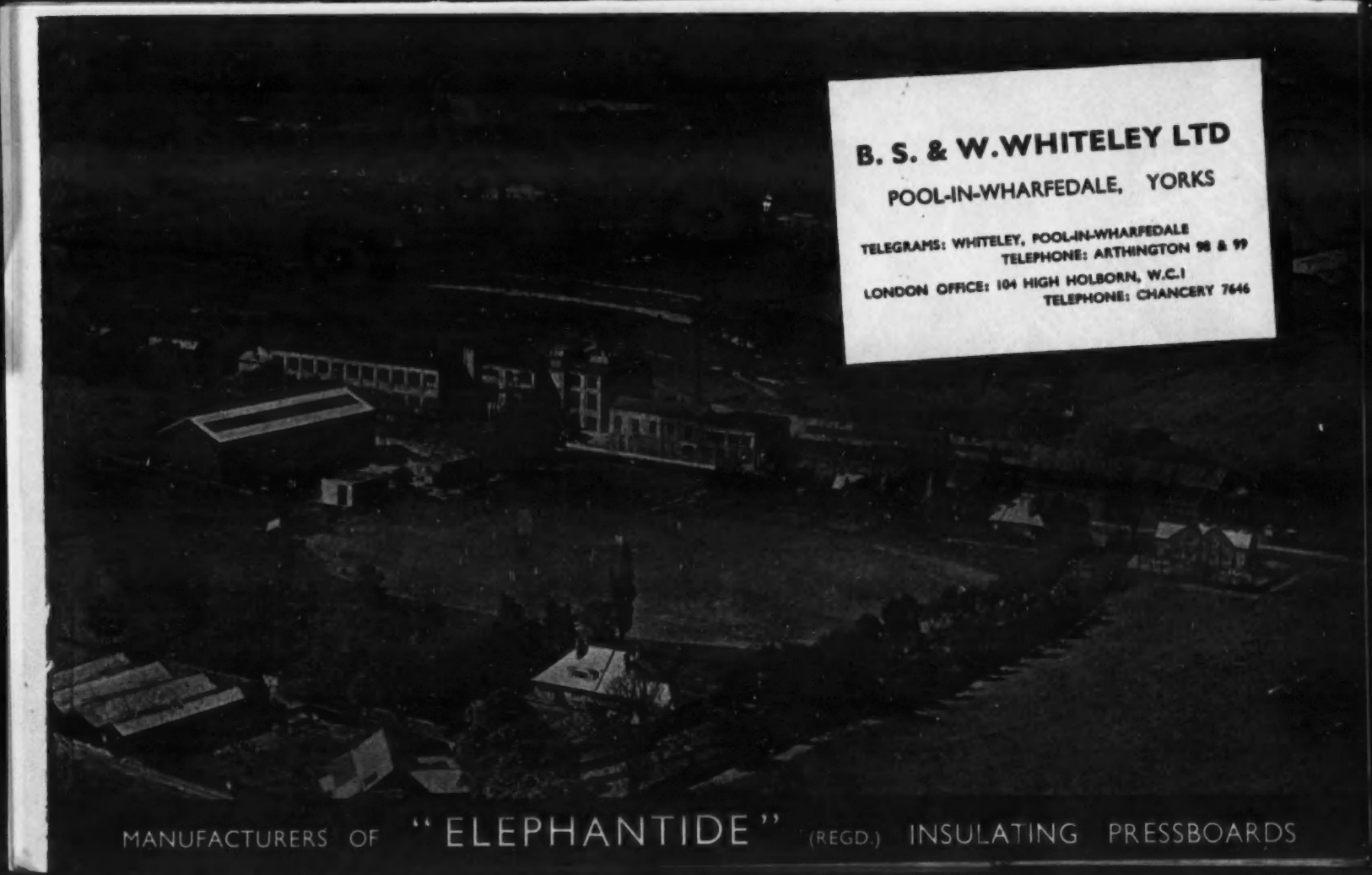

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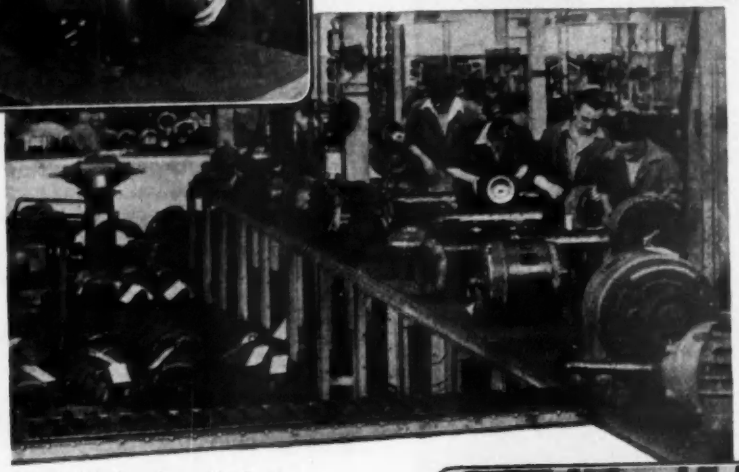

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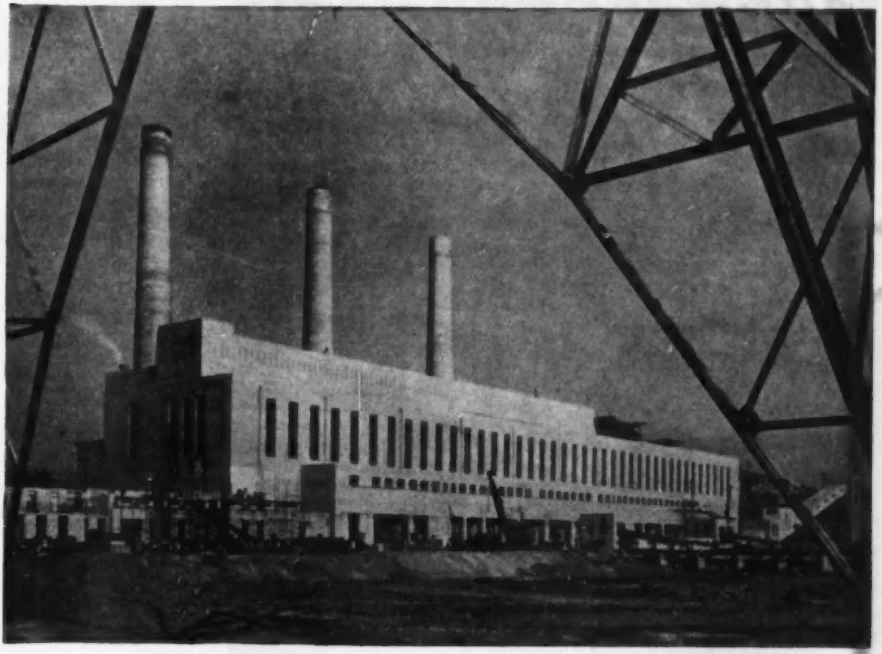

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How we are working

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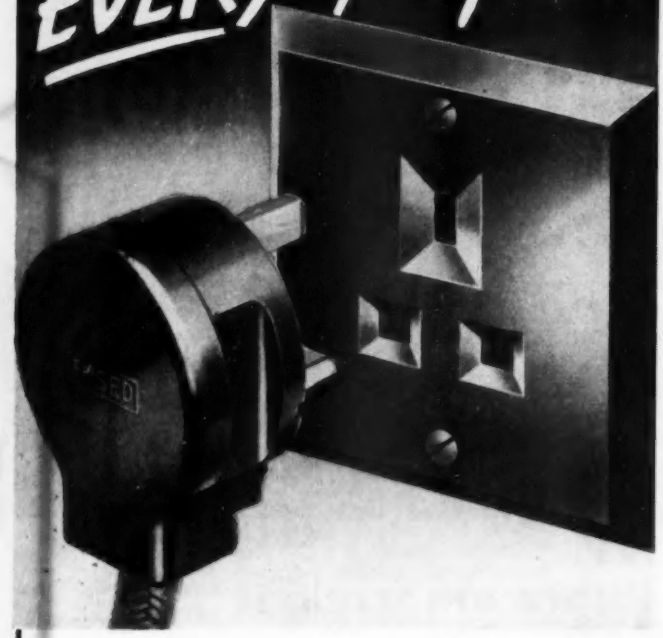

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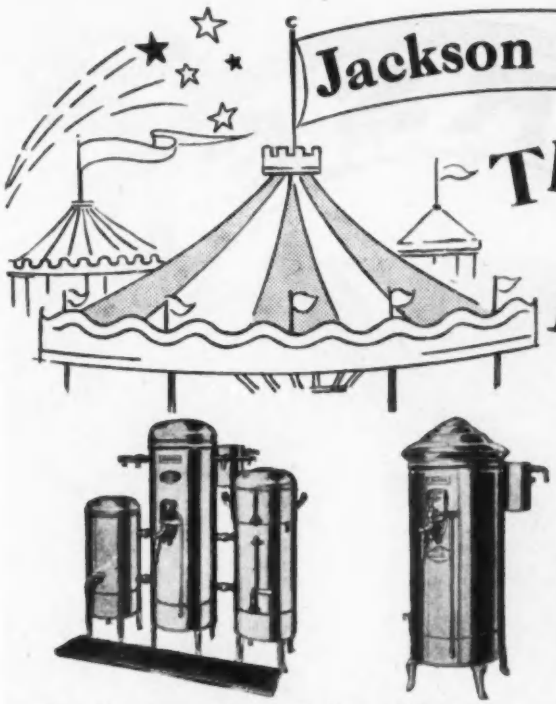

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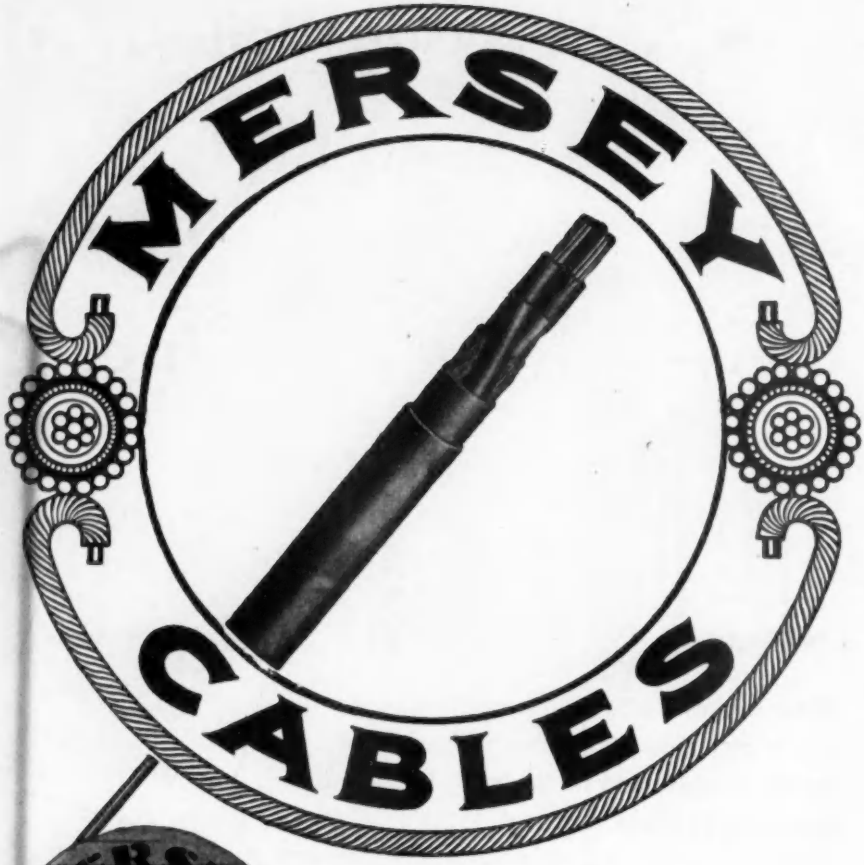

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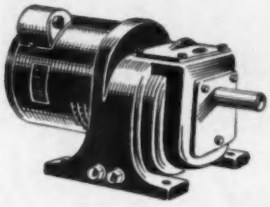
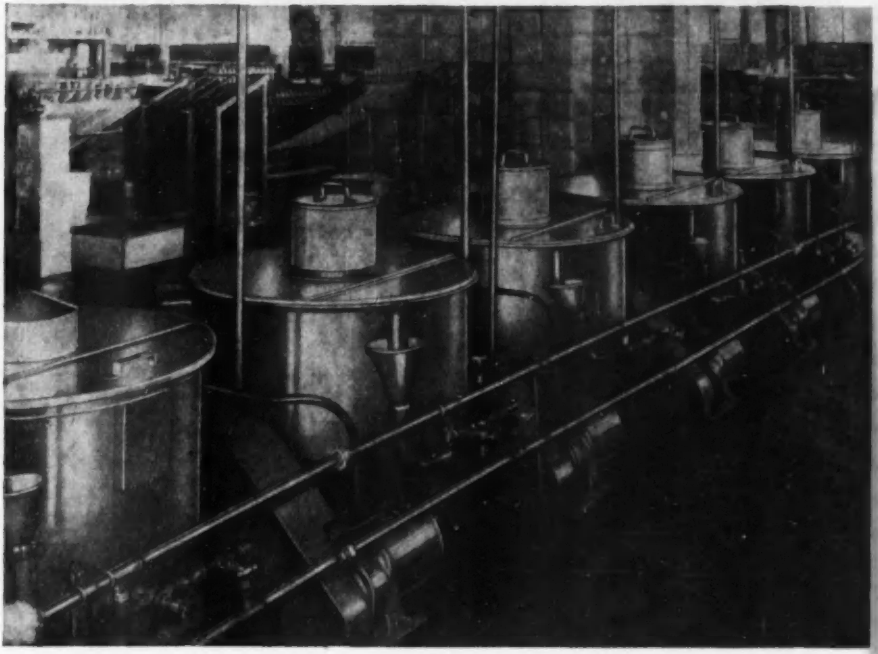


A geared motor with a sweet tooth



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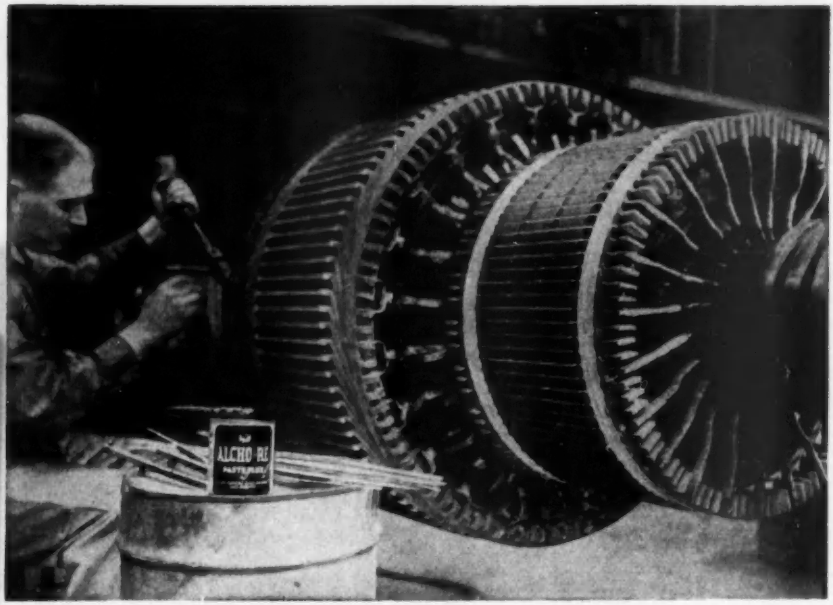

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ELECTRICAL TIMES

Vol. 117 No. 3036 THURSDAY, JANUARY 12, 1950

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PUBLISHED EVERY THURSDAY

IN THIS ISSUE . . . .

THE ENGLISH ELECTRIC NETWORK ANALYSER . 41
EFFECT OF INCREASED RAIL CHARGES . . 44
OUR READERS' VIEWS 45
NOTES ON WIRING *by Megohm* 46
THE HUMAN BODY *by T. C. Gilbert, A.M.I.E.E.* . 47
F.B.I. OPENS OFFICE IN TORONTO 50
MANUFACTURING PROGRESS IN 1949 . . . 51
ELECTRICAL ACCIDENTS 52
PROBLEMS AND PRACTICE IN ENGINEERING . . 54
OVERSEAS NEWS 56
PERSONALITIES IN THE INDUSTRY 58
NEW LITERATURE 60
NEW PLANT IN 1949 61
MAGNETOS FOR AIRCRAFT 62
GLARE—AND THE LIGHTING ENGINEER . . 64
THE BUYER'S COLUMN 65
THE WEEK IN NEWS 67
Electric Supply News 71
Company Activities 72
COMMERCIAL INFORMATION 73
CLASSIFIED ADVERTISEMENTS 45
INDEX TO ADVERTISERS 52

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Volume 117 No. 3036 ELECTRICAL TIMES Thursday, January 12, 1950

EDITORIAL

Honours to Nationalisation

ENGINEERS are characteristically more interested in their work than in the bubble reputation; they do not seek honours and certainly, in the past, they have not had honours thrust upon them. We have often commented on this lack of official appreciation of their work, particularly in the field of electricity supply. This situation now appears to have been changed, overnight as it were, by the advent of nationalisation. In past years, the supply industry could count itself lucky if it obtained even one award in each honours list, but in the last three lists it has averaged no less than eleven. It is true, by no means all of these are given to engineers, indeed, the proportion appears to suggest that the awards have been made on a representative basis of all sections of the industry, but the new ratio shows a complete change of heart from the indifference we have seen in former years.

The B.E.A. Pulls It Off

IN the last issue of the Old Year we referred to the deficit on plant installed which would be made up in the New Year. Now, we understand, there is to be no deficit. B.E.A. figures for December show that 826·25 MW of new plant was installed during the year. From this point of view they have not only achieved, but handsomely surpassed, their revised target. The figures for plant installed do not necessarily mean a corresponding increase in available capacity, a fact which is well known, but often overlooked. Two other factors which must be borne in mind are the scrapping or de-rating of obsolete plant and the possible lack of sufficient boiler capacity to carry full load. Taking all these into account, it seems that the amount is reduced to slightly less than 700 MW, which is much better than had been expected.

Analysers aid Export

THE inauguration, recorded elsewhere, of another large-scale network analyser will be beneficial not only to the industry itself but to the country as a whole, since strange as it may seem, it is a potent factor in obtaining export business. Overseas orders for power transmission equipment tend to go to the country which can give a complete study of the engineering problems involved. With the ever-increasing complexity of modern transmission systems, comprehensive analysis of power flow and system stability problems becomes essential, and at the same time more complex. Mathematical analysis, while theoretically possible, becomes impracticable—if only on account of the time factor involved. It is no exaggeration to say that with many overseas inquiries, mathematical analysis could not be carried out before the closing date of the tender.

Hunting the Var

THE advent of the new analyser also increases the facilities available for accurate load flow studies on complex networks. The d.c. calculator, first developed in this country more than a quarter of a century ago, gives reasonable results where transmission distances are not unduly long and the system has a limited number of mesh or ring inter-connections. When these conditions are not satisfied the d.c. calculator, which cannot for all practical purposes take account of power factor

differences, becomes only a rough and ready method of computation. The importance of accurate flow study in obtaining maximum operational economy is emphasised by the fact that the 20 analysers installed in the U.S. spend approximately 60% of their time on this work alone.

Devaluation—First Fruits?

AS noted in our Overseas News recently it is reported from the U.S. that two British firms have submitted tenders to the Seattle City Light Co., which are considerably lower than those of American competitors. Figures quoted show, for example, that one bid for nine water-cooled transformers was £34,000 less than the lowest American tender. Some discussion has arisen on the inclusion of a 10% adjustment clause to cover possible future rises in labour or materials but, on the figures quoted, the operation of such a clause would still leave a reasonable margin. It will be interesting to see whether the inevitable minor departures from American specifications and the natural prejudice against the importation of foreign heavy plant will outweigh price considerations and still render the U.S. a closed shop for our heavy industry. If not, and the orders are secured, devaluation will at least have made a token offering in favour of the electrical industry as against the many disadvantages which it has brought in rising prices of raw materials. It will also show that British firms are taking full advantage of the improved price situation in the dollar markets.

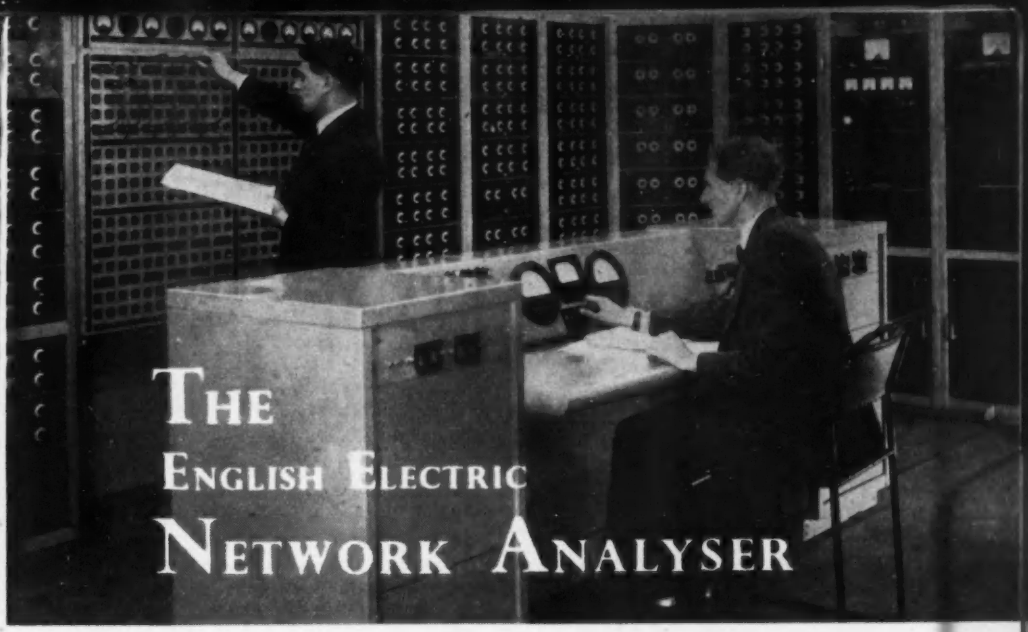
What Is a Safe Voltage?

AS we pointed out a few weeks ago, very little work has been done in this country on the effects of electric shock on the human frame, despite the fact that such knowledge is of real importance not only to the industry but to the nation. An article on page 47 of this issue summarises the results of experiments conducted abroad and elicits some remarkable results. The variation in tolerance between individuals is well known, also the variation of resistance in a single individual. But it is not always realised that a dangerous situation can exist with pressures as low as 30 V when the hands are dry or with 20 V when wet. We pay no attention to the figure of 9 V for a person sitting in a bath, for the electrical industry well knows the dangers which lurk in this most useful of rooms. The results are not without their amusing side, however. What scientific explanation can be put forward for those with rectifier conductivity, the right hand having double the resistance of the left? But the cream of the whole series was the case of the workman whose body resistance fell considerably every time he ate pickles. Shall we yet see the march of progress leading to the development of low voltage safety apparatus classified as pickle-proof?

The Chronicles of an Amp

IN veneration of a great scientist, the unit of current was named "the ampère"; as a tribute to the electrical ubiquity of this unit it is generally abridged to "the amp" and in this form it has achieved the distinction of acceptance as a British Standard abbreviation. We were surprised, therefore, to learn that this colloquial word is eschewed by the I.E.E. and is excluded from the approved list of symbols for National Certificate courses. The only word that is to be permitted students, while training to be practical engineers, is the academically flavoured "ampere." No doubt this usage gives a professional air to those students' exercises which would otherwise hardly merit such a classification, but even greater distinction might be found by restoring the accent which has long fallen into disuse. Otherwise, the student may be tempted to pronounce "ampere" phonetically to rhyme with "mere" instead of the more Oxonian "amp-pair." We ourselves, however, place our faith in the mundane "amp." It has had a currency almost as long as the industry itself and has the merit of saving time in answering examination questions.

Meteor



THE ENGLISH ELECTRIC NETWORK ANALYSER

THE use of a.c. network analysers for the solution of transmission problems has become almost a commonplace in the United States over the past few years. This is, of course, mainly due to the extensive high tension distribution systems which have developed in that country. In Great Britain, however, the development of these calculating boards has not been so rapid. In fact, up to the present there have only been two large boards in regular use—the Blackburn analyser at Newcastle and the A.E.I. a.c. network analyser at Willesden. With the growth of electricity systems overseas, it has become a matter of urgency that if the British manufacturer is to compete on level terms with his American counterpart he should have access to this type of analyser. The reason for this is not far to seek.

Many tenders from overseas specify that the behaviour of plant and networks shall be included as an integral part of the contract. If the British manufacturer has to work this out by a rigid mathemetical analysis, the time and labour involved is excessive in cost and may in many cases result in the loss of the contract. If, however, a network analyser is available this expense is largely eliminated. A further point worthy of consideration is that the people who plan the network very often get the orders for the plant.

For these reasons we were pleased to see the English Electric network analyser in operation last week at the Nelson Laboratories, Stafford.

General Description

As is generally known, a network analyser consists of components representing the inductances, capacitances, transformers, generators and loads which may be connected together in such a manner as to represent an electrical equivalent of any network. Certain restrictions are, however, imposed on the design of the machine. The first is generally space. If, for example, the resistance/inductance ratio of transformers is considered, it can be seen that as the size of the transformer decreases the ratio rises. At 50 c/s therefore the transformers required within the analyser would be of considerable size to keep this ratio analogous to a large scale unit. This can, however, be overcome by raising the frequency at which the analyser functions. A limit is, however, set by the fact that the capacitative impedance decreases as the frequency rises, and as many wires run closely together in the analyser, coupling between them may occur and give spurious results. A compromise has to be sought, and in this case the frequency selected is 500 c.s.

The units used to represent the network are 220 in number, made up of twelve generator units, 64 low impedance units (10-500 ohms), 48 medium impedance units (100-5,000 ohms), thirty-two high impedance units (1,000-50,000 ohms), twenty-four capacitance units (10-1,000 ohms), sixteen coupling transformers (1:1, 2:1, $\sqrt{3}$:1), and twenty-four auto transformers.

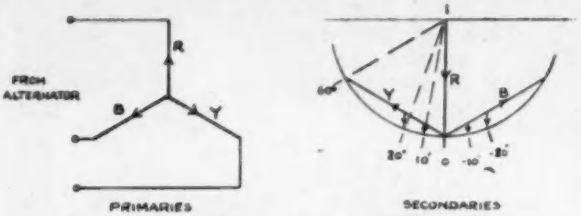


Fig. 1. Principles of phase shifting transformer system

These units are arranged in racks round the room, the connections to each being brought out to a central plugboard. In the centre of the room is located the control desk housing the meters and metering selector controls.

Arrangement of Analyser

The power feed for the analyser is provided from a 500 c/s three-phase alternator, electronically stabilised both for frequency and constancy of voltage. This output is at 250 volts and is fed to a bank of transformers each with several taps or secondary windings so interconnected as to give nineteen voltage sources, all equal in magnitude but differing in phase by steps of 10°.

The vector diagram shown in Fig. 1 illustrates how vectors at 0°, 10°, 20°, and 60° are produced by utilising windings on the transformers, whose primaries are connected in the red and yellow phases of the alternator. A transformer on the blue phase is used to cover the opposite half of the semicircle. A phase-shifting device covering 0-180° is adequate since voltages with phases in the range 180°-360° are merely the reverse of these in the lower range. Phase equalising equipment has been provided on the alternator to maintain the phase voltages spaced at 120°. The feed to the board is kept approximately at 50 volts 50 mA, which enables components to be kept fairly small and also is within the handling capacity of telephone type selector relays.

Generators

From the supply system, the power is taken to the units representing generators. These must provide a voltage source variable both in magnitude and phase. Variation of phase in steps of ½° is obtained by switching to a suitable pair of voltage vectors spaced at 10° available from the coarse phase shifting network described above.

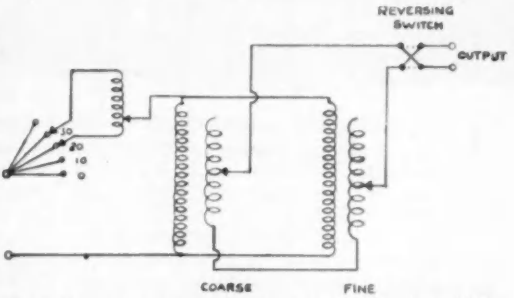


Fig. 2. Generator unit showing arrangements for phase shifting

The method of obtaining this angle is shown in Fig. 2, where an auto-transformer with twenty taps is used. It will be noted that the voltage vector is actually shifted along the subtended chord, but for an angle of 10° this is substantially equivalent to moving round the car. Variation of voltage magnitude is then obtained in 25 coarse steps of 10% from 60% to 300% of the base analyser voltage by means of taps on the coarse voltage transformer. In series with this is a fine voltage transformer which provides twenty ½% steps. This system provides voltage sources with

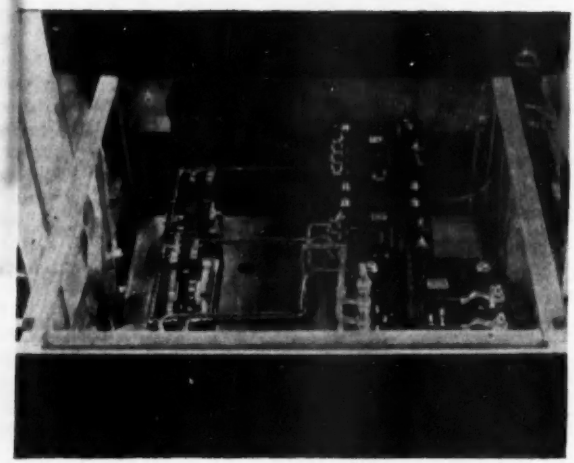


Fig. 3. Tapped transformer units and contactors

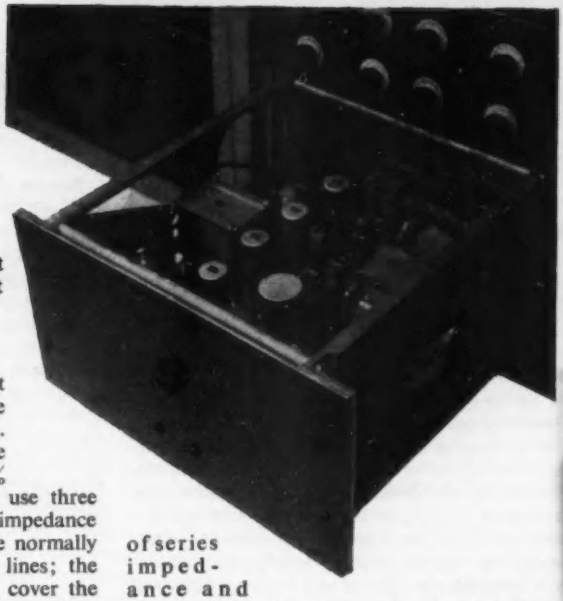


Fig. 4. Meter amplifiers such as this allow readings to be taken without affecting network loading

good voltage regulation dependent only on the design of the component transformers.

Impedance Units

Using a base voltage and current of 50 volts and 50 mA, the base impedance is of course 1,000 ohms. It was decided to cover an impedance range of from 1% to 5,000% of the basic impedance and to use three types of units to do this. The low impedance units (1% to 50%) cover the range normally required to simulate transmission lines; the medium units from 10% to 500% cover the normal requirements for loads and synchronous machines or transformer impedance. The high impedance units would normally only be required for very small loads or leakages on transmission lines. All of them, however, perform a similar function and are not restricted to the uses given above, and they are interchangeable when setting impedance values for which their ranges overlap. The design of the impedance is such that resistance and reactance have to be set up in magnitude and ratio.

Fig. 5 shows a schematic diagram of the circuit used in an impedance unit. A fixed resistance is connected across the ratio transformer, and by switching to different taps on this transformer the ratio of the magnitude transformer is varied. Two ranges of taps, shown on the left and right of the magnitude transformer enable coarse and fine adjustments to be made to the magnitude of the impedance reflected across the terminals of the unit. In the complete design correcting devices have been incorporated to compensate for the effects of series impedance and magnetising currents of the transformers. The ratio can be set from 0·06 to 1·5 in steps of 0·01 and by means of the coarse and fine taps on the magnitude transformer, any desired impedance in the 50:1 range covered by a unit can be set to within 1%. When resistance exceeds reactance, a reversing switch interchanges the roles of the fixed resistance and reactance enabling an impedance to be set up with a ratio of reactance to resistance in the range 0·06 to 1·5.

Nearly all impedances encountered in power systems fall within the ratio range catered for in these units, although for setting up loads at unity power factor some units have been constructed with separate decades of resistance and inductance.

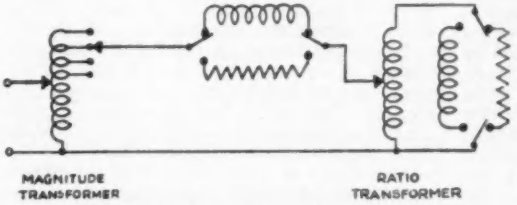


Fig. 5. Schematic diagram of impedence unit connections

Other Units

The capacitance units are used to include the effects of line charging currents, where a line can be represented by its equivalent "π" network. Included are also a number of auto and double transformers which can be used to study the effects of tap changing and for introducing the mutual coupling required between circuits.

Metering is carried out by selecting the appropriate points in the network by means of uniselector banks. The operator at the control desk has therefore only to "dial" the required point on the network to have the voltage, current, watts, and vars at that point presented to him on the meters.

E

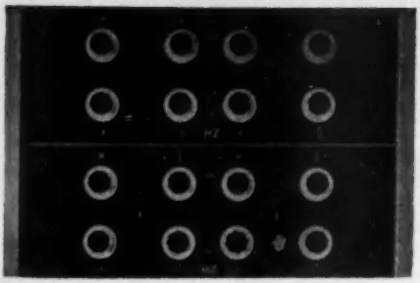


Fig. 5.—Front view of two high-impedance units

In order to prevent the meter load being imposed on the board network, connection to the meters is made through amplifiers which also are set to give specified gains so that the sensitivity of the meters may be varied to give ratios of 1, 2, 5 and 10. This implies that the current readings must be presented to the amplifiers in the form of voltage and this is obtained by the introduction of permanently fitted shunts across the plug board contacts.

Utilisation

Normally a network study for unbalanced load is carried out by means of symmetrical components and provision has been included in the design for the addition of relay and phase shifting networks to perform the automatic summation of the currents and voltages in the three sequence networks of a symmetrical component study, to give direct readings of these quantities for the three separate phases. The board is, however, so arranged that the three phases can be handled independently if necessary.

Besides dealing with network problems, the analyser can be used to solve certain dynamic and structural problems which can be reduced to electrical analogy, and can also be used by "step-by-step" methods in problems of transient phenomena.

Speaking at the inauguration of this instrument last month, Sir John Hacking, Deputy Chairman (Operation) of the B.E.A., said that network analysers of this type were very much in need in this country. In this respect we were somewhat behind our colleagues in the United States. Speaking from memory, he thought there were about a score of these boards in operation in that country and he thought all of them were in regular use. The need for these analysers would be still further accentuated in the future when the superimposing on the 132 kV grid of a backbone grid of still higher voltage took place.

We understand that this analyser will be open for use by outside bodies, although staffed by members of the Nelson Laboratories.

Our thanks are due to Mr. J. K. Brown, Director of Research at the Laboratories, and to his colleagues on the staff for their kindness in allowing us to examine the analyser and for the information given in this article.

EFFECT OF INCREASED RAIL CHARGES

THE increases in railway freight charges proposed by the British Transport Commission would, if put into force, cost the British Electricity Authority an additional £1,500,000 in the year 1950-51, or £1,750,000 if the increases were extended to the canals, stated Mr. E. S. Fay, representing the B.E.A. at the Transport Tribunal which commenced in London last week.

During his cross-examination of Mr. R. H. Wilson, comptroller of the British Transport Commission, Mr. Fay remarked that the B.E.A. was one of the largest users of transport. In 1948 approximately 17 million tons of coal was conveyed by rail to the generating stations, and in 1950 it was anticipated the figure would be 19·7 million tons. Like the B.T.C., the B.E.A. was bound by the terms of the Act to balance its books, therefore any increase would have to be passed on to the consumers, he maintained. Even if some new process was discovered which gave the B.E.A. greater efficiency enabling the extra cost to be absorbed, the effect would still be that electricity consumers would be £1,750,000 a year poorer.

Later Mr. Fay raised questions concerning the cost of transporting coal, during which he maintained that there had been no fundamental change in the relative costs of moving various commodities since 1891 at least.

Earlier, in presenting the case for increased charges, it was stated that in 1948, the Commission's first year of operation, there was a loss of £4,750,000, and there were no reserves carried forward from earlier years on which to draw. For 1949 a deficit in excess of £20 millions was expected, and it was considered likely that the deficit in 1950 would be about £30 millions. The Commission proposed to increase the existing level of railway freight rates by 16⅔%, which would yield an additional £27 million p.a.

During questioning on Tuesday, Mr. Fay said the B.E.A. supported the proposals of the Coal Board for preferential charges for coal traffic. He also referred to the probability of new generating stations being erected at or near coalfields, thereby reducing transport charges.

At the time of going to press we understand that the case for the B.E.A.'s opposition to the proposals would be presented today, Thursday.

OUR READERS' VIEWS

Heat Pumps

Meteor's remarks in your issue of January 5 on the possibility of using a heat pump for heating the concert hall at the Festival of Britain, are timely. A comparatively large installation of this type appears to be a definite requirement if we are to develop this method of utilising low-grade heat in this country.

At the moment, apart from Mr. Sumner's plant at Norwich, one or two specialised power station applications, and the equipment at the E.R.A. (which is, I believe, of German manufacture) there seems to be no large commercial installation in operation in this country. Without demand there can be no manufacture, and without manufacture no development.

The Festival authorities would be helping the engineering industry in more ways than one if they could see their way to going ahead with this project.

C. Oppenheimer

Woburn Place, W.C.1.

Bloom Street Works

Your references to the above (Electrical Times, December 23, 1949) will interest those few of us who remain who were with the Manchester Corporation Electricity Works when the station was being built in 1901. In my article: "Manchester in 1901," which you published (August 12, 1943), I recalled that each of the four 1,800 kW sets had to be dismantled owing to the keys holding the 125-ton fly wheels becoming loose. In the short street outside the station, a gantry, made of huge baulks of timber, had to be erected to carry an overhead crane to handle the immense weights involved.

The story of this plant dismantling and re-erection has, I believe, never been told, but it would make an epic in the records of the engine-builders' craft. The keys were replaced by shrinkage rings which had originally been recommended by that world famous firm, John Musgrave and Sons, who had been given the contract for the steam plant.

W. E. Warrilow, M.I.E.E.

Bournemouth.

Tax on Immersion Heaters

Like myself no doubt quite a number of readers were surprised at the contents of a paragraph "P.T. on Immersion Heaters" under the section Questions in Parliament (page 924 of your issue dated December 29, 1949) where it appears that Sir Stafford Cripps, in reply to Mr. I. Thomas, stated that, on the advice of the Minister of Fuel and Power, immersion heaters were being excluded from the proposed reduction in Purchase Tax inasmuch as they contribute largely to the peak load on the mains.

It may interest you to know that I have been responsible for many hundreds of water heating installations in different parts of the country, and a considerable percentage were conversion jobs calling for one of the range of immersion heaters available, and I think it would be true to say that probably 90% of the immersion heaters fitted have had a load of 2 kW. In no case is an ordinary domestic installation provided with a heater of more than 3 kW capacity.

We all know that electric water heating conversions have to be handled intelligently, but the fact that such installations have been carried out indicates that the pipe systems in question and the systems generally, lend themselves, and have resulted in a good service, and economic results and particular attention has always been paid to efficient lagging to ensure the highest possible thermal efficiency and consequently keeping the heat source to the very minimum consistent with obtaining good results.

2kW automatic immersion heaters have been used in water vessels having a content of up to 40 gallons. The standard thermal storage water heater of 40 gallon capacity is usually loaded at a minimum of 3 kW.

Having regard to the foregoing, and no doubt the experience of many of your readers, I would suggest that the Chancellor was ill-informed and that further, the Water Heating Committee of the Electrical Development Association could look into this matter and make the necessary representations.

Gordon V. Radford

Haywards Heath.

FACTORY REPORT—1948

Some Notes on H.M. Chief Inspector's latest Report

I HAVE now had an opportunity of studying in more detail the annual report of H.M. Chief Inspector of Factories for the year 1948, briefly referred to in the ELECTRICAL TIMES dated December 29, 1949. It is a pity that the publication of these reports now lags so far behind the period covered by them; and it is to be hoped that this delay can be reduced in future years, not only because an out-of-date publication is of lesser value, than an up-to-date one, but also because the latter will command a much wider interest, and consequently, be of much greater benefit to those concerned.

NOTES ON WIRING by Megohm

General trend

From the personal point of view, we may regret that the Electrical Inspectors' report is interspersed with those of the other branches of the inspectorate, but in some respects this arrangement has its advantages, as it brings to our notice associated matters of factory workings and kindred developments which may be of interest.

As an example of this, I notice that due to fuel shortage, and possibly also due to the higher cost of fuel, more attention is now being given to improved heating and ventilating schemes; most of which incorporate electrical features, either in the form of additional pumps and fans, or, in other instances, relays, thermostats or recording devices. Directional heating by means of forced draught from a fan through a fixed heating element, not necessarily electrically heated, seems to be finding favour for many purposes, and air washing and filtering and extraction all have their applications, according to the manufacturing processes involved in the various works.

Another point made in the report draws attention to the dangers present where inflammable or explosive dust may be produced from substances such as coal, aluminium, moulding powder, cork, sulphur, etc., and it is clear that the actual working conditions must always be fully considered when an installation is planned originally.

Factory lighting

The section dealing with lighting problems has now for some years been incorporated in the miscellaneous Health and Welfare section, and I suppose that it is a sign of the times that so much stress should be placed on the psychological, as distinct from the utilitarian, aspect, of lighting and decoration. I would be the last person to suggest that we should return to the bad old days, when work was carried out in dark and dismal surroundings, but I am not so sure that the pendulum is not swinging a bit too far the other way. As a relevant side issue of this, I should positively hate to work in a large room with a loud-speaker blazing forth the latest so-called music throughout the length of my working day. But perhaps I am in the minority, or it may be that my work is not of a mechanical, repetitive nature.

To return to the lighting. It would appear that the advent of the fluorescent lamp has changed our standards, and as a result of the improved lighting, the condition of the dirty and dingy walls and surroundings have thrust themselves upon our notice, with the result that cleaning and re-decorating in brighter and more harmonious colours, has become the order of the day. The results of this though, have been twofold.

In some instances the brighter colours have not remained bright for very long, and have not been restored for reasons of economy, with a consequent loss of efficiency.

The other result has been that in some instances though the illumination was all that could be desired, the actual results were far from satisfactory, due to the dreary and uninteresting "flatness" produced by an almost shadowless installation. A certain amount of contrast is necessary to the eye and the report points out that certain re-arrangements of the lighting, the introduction of some colour or contrasting lighting, to focus the eye, has been found most useful if properly arranged. With this view I am in entire agreement and I rather favour a mixture of fluorescent and tungsten lighting for most ordinary purposes.

Safety and Health Museum

A brief reference is also made in the report to the extensions and developments carried out at the Museum in Horseferry Road, London, organised by the Department, and visited by nearly 13,300 people during the year in question. The existence of this establishment is not sufficiently well known, but I can testify from personal experience to the many interesting and instructive exhibits and demonstrations to be found there and to the never-failing courtesy and helpful advice which the staff so willingly place at the disposal of any visitor.

The wide scope of the museum is indicated by the title and even if no immediate problem is involved, a visit, however brief, is both useful and instructive to anyone anxious to keep in touch with modern developments.

The Human Body

—its reaction to the passage of alternating current shown in some Swiss experiments

By T. C. GILBERT, A.M.I.E.E.

THE paper dealing with this subject and read before the Institution by Dr. Macdonald Critchley in December last, with the subsequent discussion, whilst raising considerable interest indicated yet again the serious lack of documented information on the behaviour of the human body under shock conditions, and the almost complete impossibility of stating with any degree of certainty what constitutes safe or dangerous conditions. No serious research or investigation appears to have been carried out in this country, so far as the writer is aware, but there is a certain amount of information available from sources abroad.

The information contained in this article is taken from a report of investigations carried out some years ago by Elektrizitatswerken des Kantons Zurich with twenty-five people in order to ascertain, if possible quantitatively, the

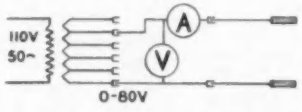


Fig. 1. Apparatus used for tests

dangers of a.c. currents at 50 cycles flowing through the human body. The results show the range and complexity of the many variable factors involved, but it will be noted that the time factor is one of the most important of these, and which in the Institution discussion was, in the opinion of the writer, insufficiently stressed.

For the purpose of the tests, a dangerous current was taken to be one from which the victim is unable to effect his own release, and tested with hand electrodes 20 mm. in diameter and 160 mm. long, this was established as about 15 mA. The long list of test results will not be shown here, but are available for interested readers; only the graphs summarising the results will be reproduced, as they appear to convey all necessary information.

It will be noted that hand-hand or hand-foot resistances may be as low as 2,000 ohms, and under unfavourable conditions, e.g. industrial or domestic, 1,300 ohms. On this basis, a dangerous voltage for the most sensitive people with the current passing hand-hand is about 30 V (dry hands) and 20 V (wet hands). For a person seated in a bath, and grasping live equipment, dangerous conditions may be represented by no more than 9 V.

No two of the twenty-five people tested reacted alike, but an average may be taken as shown in Table 1.

In connection with these and following results, it should be noted that the persons under test were aware and prepared; with sudden shock, conditions are worsened, but no tests were possible in this diection.

Attempts have been made in the past to specify a safety limit, voltage being taken as a scale of measurement, but analysis of accidents shows that voltage alone cannot be a deciding factor. Assumptions that the current flowing is the real danger are also unsatisfactory, as the many variable factors make it impossible to determine danger by any single value, and the only controllable factor appears to be that associated with the time that the victim is exposed to the danger.

Preliminary resistance measurements of the resistance of the human body by means of a bridge led to no results of value, and the tests under consideration were therefore made with current and voltage measurements. Fig. 1 shows the general arrangement of the equipment used, a double-wound step-down transformer with secondary tapped 0-50 volts, a Weston voltmeter, dead-beat ammeter reading 0-15 mA, with two electrodes. These latter were fitted into easy plugs, which could be instantly withdrawn by a person under stress.

TABLE 1

VOLTAGE	WET HANDS		DRY HANDS	
	Current A	Res. Ohms	Current A	Res. Ohms
10	0·001	10,000		
20	0·0022	9,100		
30	0·0135	2,220		
40	0·0205	1,955		
50	Too painful for further tests		0·0001	500,000
60			0·0008	75,000
70			0·0018	38,900
80			0·0100	8,000
90			Too painful for further tests	

The tests showed that although the body resistance of individuals varied considerably, yet the sensations experienced and reactions to the same current were very similar. The graphs in Fig. 2 show body resistances under varying conditions, all twenty-five results being contained between the upper and lower limit curves, but the point of interest lies in the fact that resistance falls considerably with any increase in current flowing; this is also shown in Fig. 3 (a).

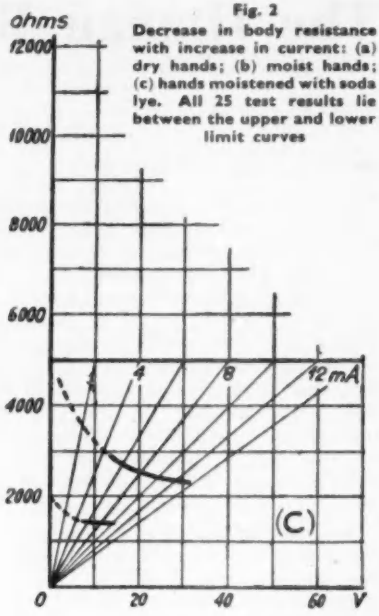
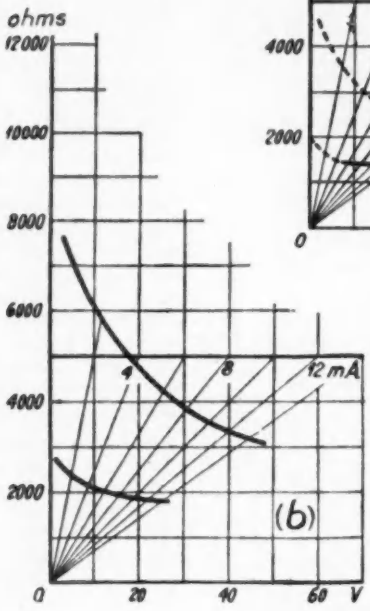
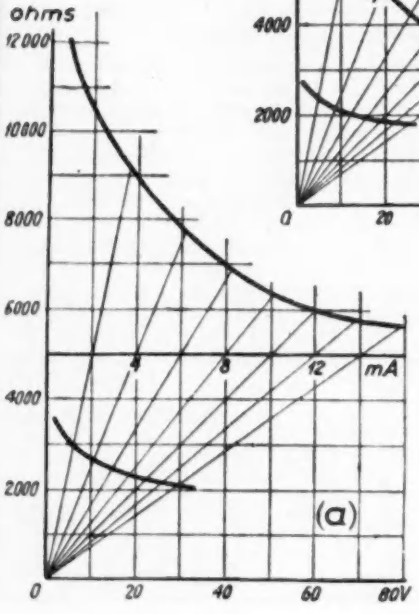


Fig. 2
Decrease in body resistance with increase in current: (a) dry hands; (b) moist hands; (c) hands moistened with soda lye. All 25 test results lie between the upper and lower limit curves

The resistance of the human body is composed of three resistances in series, points of entry and outlet of current, and the portion of the body intervening between these two. As the latter is extremely small in comparison, it may be ignored, with concentration upon the other two, but these are again affected by certain influences, such as thickness of skin and area of contact. These may vary with one and the same person for different parts of the body, and with some people there are substantial differences. Practically the only factor to influence skin resistance is moisture, usually controlled by external conditions, as it increases with increasing air moisture, rising temperatures, and by moistening with water or other liquids, conditions applying especially to bathrooms, kitchens and industrial works.





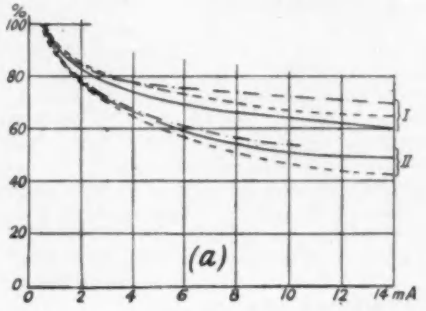
Skin moisture is also influenced by perspiration, usually formed by manual labour or high temperatures, although with some people shock or fear may have the same effect. One mechanic under test revealed that he was subject to profuse perspiration after his midday meal with pickles, and it was established that his body resistance prior to his meal was considerably higher than immediately after. It can be seen, therefore, that unpredictable influences have considerable physiological and psychological effect upon a person's safety, a point stressed by Dr. Critchley in his address.

Fig. 3 shows the variation from initial resistance with (*a*) increase in current flow, and (*b*) increase in time of application. The danger of relying upon such general results is, how-

ever, shown in Fig. 4, representing the variation of resistance with time of current flow in the cases of exceptional individuals. One person under test experienced considerable fright when the current was applied, with the result that a body resistance of barely 1,000 ohms was recorded; later, however, with the application of further tests, the resistance of this individual rose to within the limits shown. This may explain the occasional fatality on very low voltages, and other freak results were a person with double the resistance of the right hand to that of the left hand, and with a left-handed man the reverse.

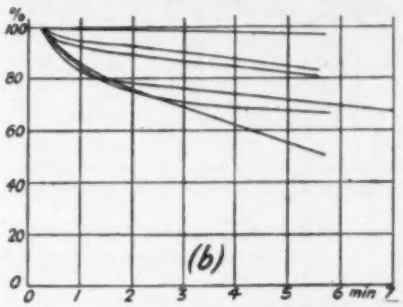
It may be generally stated, however, that when a person comes into contact with a live circuit, it is immaterial whether this contact is

Fig. 3. Variation of body's initial resistance with
(a) increase in current flow
(b) increase in time of application



intentional or accidental, as for the first moment only his initial condition or initial resistance is the deciding factor. From the moment of contact, however, effects of the current flowing immediately appear, having effect upon the muscles which increasingly contract with cramp. This strain may lead to the production of perspiration, and explains how with increasing current, as with long-continued application, there is a decrease in resistance. The test results in this direction were fairly consistent, as shown by the graphs. Tests were extended to hand-foot, and foot-foot, with similar results, but with low voltage complete insulation was effected with shoes with rubber soles, or by standing on cork or straw. According to the conditions of the shoes in respect of heavy nailing or moisture, resistances foot-foot varied between 1,300 ohms to infinity; resistances hand-foot varied for the same reasons between 2,000 ohms and infinity.

Careful tests were made to determine the dependence of body resistance upon the size of



contact area, measured by blackening the electrodes prior to holding and assessing the discoloured areas on the hands. As contacts were never exactly alike there were, as would be expected, slight differences, but a brief summary of some of the tests are given in Table 2. Apparently with equal current density and condition of the skin, the resistance may be taken as in inverse ratio to the contact surface.

Accepting that a dangerous current is that from which self-release is difficult or impossible, and that for all the persons under test was represented by 15 m/A, for most sensitive people under unfavourable conditions, with current flow between dry hands, a dangerous voltage might be as low as 30 volts (2,000—

TABLE 2. TESTS ON INDIVIDUALS WITH VARYING CONTACT SURFACES. HANDS DRY. RESISTANCES WITH CURRENT FLOW HAND-HAND

Electrode dia. mm.	Form of contact	V.	m/A	Res. ohms	Contact surface cm²	Body res. per cm², ohms	Skin res. per cm², ohms	m/A per cm² of surface
9	Both hands grip	35	8·0	4,375	18	78,700	39,350	0·445
9	Do.	42	9·0	4,670	18	84,000	42,000	0·500
20	Both hands, three fingertips	44	3·0	14,700	5·5	80,800	40,400	0·545
20	Both hands, fist clenched	44	1·9	23,400	3·2	75,000	37,500	0·593
20	One hand and one finger	45	0·4	112,000	0·75	84,000	42,000	0·533
20	Both hands grip	34	11·6	2,940	30·0	88,200	44,100	0·386
20	Do.	34	9·35	3,640	30·0	109,000	54,500	0·312
9	Do.	34	4·35	7,820	14·0	109,200	54,600	0·276
9	Do.	39·9	5·86	6,730	14·0	94,200	47,100	0·418
9	Do.	35·4	5·27	6,810	14·0	95,300	47,650	0·376
9	Do.	27·5	3·93	6,970	14·0	97,300	48,650	0·286

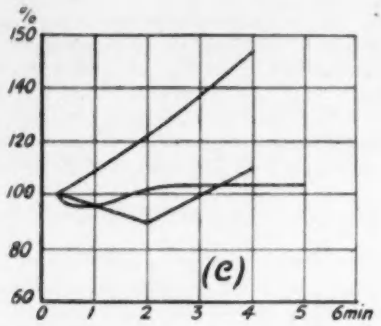


Fig. 4. Variation in body resistance with time of current flow in cases of exceptional persons

0·015), and with moist hands 22 volts (1,500—0·015). This applies, however, under the assumption that the contact surface area is comparatively small, about 2×30 cm² but for a person seated in a bath there is considerably greater danger. Taking 15,000 cm² (1·5 m²) as the wet portion of the body and 30 cm² for the hand in contact, a body resistance of 752 ohms is obtained, and the dangerous voltage in this case would be $752 \times 0{\cdot}015$, or 11·3 volts.

On the other hand, this reasoning cannot be applied to very small contact surfaces. For example, should 1 cm² of skin have a resistance of 30,000 ohms then 1 mm² would have a resistance of 3 million ohms, and a person would have to contact 45,000 volts before receiving a shock of 15 m/A, which is, of course, fallacious. This shows that not only is the current strength important, but also the specific current; a current of 15 m/A per cm² effects physical and chemical changes in the skin, causing much higher conductivity, but tests cannot be carried out to this length.

From this necessarily condensed summary of the test results one thing stands out most clearly —that extension of the time of current flow acts in a similar manner to an increase in current, and that a light electrification of long duration may be as lethal as heavy electrification of short duration. It would appear from the welter of unpredictable and variable individual factors associated with body reaction to current flow, effective protective measures can only be applied along the lines of securing the isolation of a faulty circuit or the release of the victim in the shortest possible time, certainly under one second, if possible.

Protective equipment based upon principles of voltage or current limitation, and which at the same time ignores the vital time factor, can hardly be effective in most cases of accidental contact with live circuits, but the problem would not appear to be insoluble. In fact, the modern voltage - operated leakage circuit breaker, operating within two to three alternations of the supply frequency, goes a long way towards the desired objective, and its recognition of the time factor should be rated in value above its ability to respond to predetermined voltages.

F.B.I. opens office in Toronto

PLANS to assist British manufacturers in the Canadian market were simultaneously announced in London and Toronto by the Federation of British Industries last week. Recognising the overriding importance of increasing Britain's exports to Canada, F.B.I. have decided that these new facilities will not only be available to their members, but to all manufacturers anxious to trade in Canada.

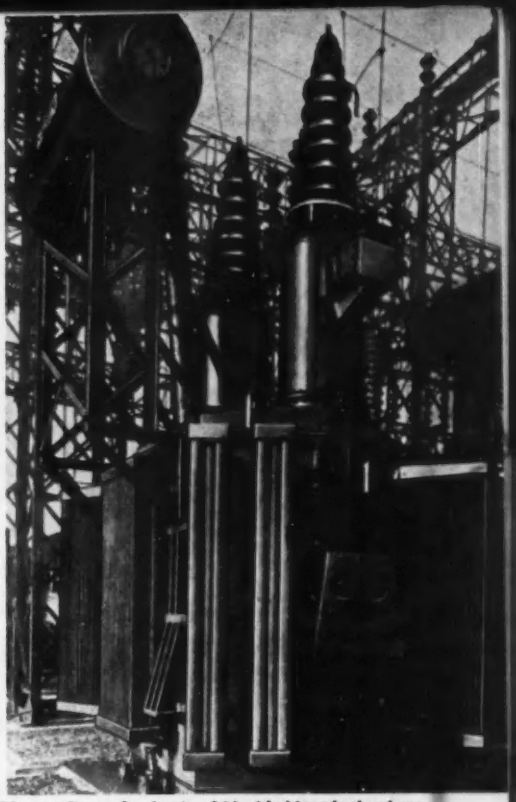
Main step taken by F.B.I. is to establish an office in the Royal Bank Building, Toronto, with Mr. Hugh D. Scully as Canadian adviser. Working closely with the Dollar Exports Board, with which F.B.I. has always been associated, the new office will extend the scope of F.B.I. representation in the Dominion. Member firms interested in the Canadian market will receive first-class advice and help from a staff maintaining close contact with the Canadian Government, trade circles, the Dollar/Sterling Trade Board (counterpart of our Dollar Exports Board) and Canadian channels of distribution. British goods will be publicised among Canadian consumers, and Canadian industrialists will be assisted in establishing contact with sources of supply in Great Britain. F.B.I. will also offer industrial groups and trade associations services and office accommodation as near as possible to their own office, so that they can be economically serviced from one pool.

Explaining the development at a London Press conference, Mr. Moir Mackenzie, deputy Director-General, F.B.I., who recently returned from Canada, said that in choosing Mr. Scully as Canadian adviser, they had looked for a man with wide experience in industry and finance. Just prior to his new appointment Mr. Scully was Canadian Consul-General in New York, and some years ago was head of the Canadian Customs department. Mr. J. H. C. Mahaffy, who would be assisting him as general manager, also had a wide knowledge of industry.

Replying to questions, Mr. Mackenzie explained that F.B.I. hoped eventually to secure the representation of as many British concerns as possible in the Royal Bank building.

MANUFACTURING PROGRESS IN 1949

No. 5—Hackbridge and Hewittic Electric Co. Ltd.



Above: Part of a bank of Hackbridge single-phase 132 kV reactors with a throughput capacity of 90 MVA

On left: Double and single tier rectifier cubicles, part of an overseas contract totalling 26 MW. The double tier bank in the background has a total capacity of more than 5 MW at 480V

THE company are able to report an exceptionally busy year in 1949 which has seen the completion of many interesting contracts, both for transformers and rectifiers.

Among these was the completion of the contract for the whole of the main and auxiliary transformers for the new Kingston power station, amounting to a total of over 170,000 kVA. In December, the fourth main generator transformer, capacity 35,295 kVA, was delivered.

The whole of the auxiliary transformers for Littlebrook "B" power station, in capacities up to 6,000 kVA and totalling 34,500 kVA, were also of Hackbridge manufacture, the last of these being delivered to site in 1949.

Largest Transformers

Largest transformers completed in 1949 were two 60,000 kVA 125,000/66,000 V, three-phase water cooled units with on-load tap changing equipment, shipped to Shawinigan Falls power station in Quebec, Canada, and put into service in the autumn. With a weight of 111 tons each and an overall height, when installed, of 26 ft, these are among the largest transformers exported from Great Britain. The value of this contract was then over 250,000 dollars

Two 12,000 kVA 42/63/6·3 kV three-phase transformers despatched to Portugal for operation at the Seia hydro-electric station of Empresa Hidro Electrica da Serra da Estrela, presented unusual problems; restricted access and transport facilities making it necessary so to design the transformers that they could be dismantled down to the component cores and winding assemblies, with the tanks also in three sections, and quickly reassembled after delivery to site.

These transformers are equipped with on-load tap changing equipment and the connections to this, and all other interconnections, were arranged in sections with bolted joints to reduce the labour of reassembly. Each unit was completely assembled and tested, then dismantled for shipment and will be re-tested as fully as possible at site after reassembly.

The year has also seen the delivery of a 16,000 kVA 115/10.5 kV Hackbridge transformer to Finland, this unit having on-load tap changing equipment on the 115 kV side, of a type in which the selector switch mechanism is mounted above the transformer on a massive

porcelain insulator, an arrangement permitting reduction of dimensions on high voltage units operating with a fully insulated neutral. This transformer, which is now installed at Oulu power station, will operate at exceptionally low winter temperatures.

In the final stages of manufacture, with the close of 1949, is a 60,000 kVA 132,000/33,000 V, three-phase transformer with on-load tap changing equipment, for Huncoat power station, this being one of two duplicate units for this station.

Reactors and Rectifiers

Large Hackbridge reactors also have been installed during the year, notably a number of 90,000 kVA capacity throughput, 132 kV single-phase units for B.E.A. substations at Coventry and Ocker Hill.

It has been a busy year for Hewittic rectifiers also, and the most noticeable feature of the company's large rectifier output in 1949 has been the high proportion of equipment for overseas installations. Many of these have been for tramway and trolley bus services all over the world, typical examples being the 1,250 kW equipments for the Toronto Transport Commission, 1,000 kW equipments for operating the tramway and trolley bus services in Hobart, and a number of 750 and 375 kW equipments for transport services in Dunedin, N.Z.

The year has shown an increasing demand for Hewittic rectifiers for the operation of heavy d.c. driven machinery in steel works and other engineering plants. The demand has also been maintained for rectifiers, often in quite large sizes, for the operation of d.c. light and power networks, one overseas contract involving the installation of over 26,000 kW of Hewittic rectifiers, arranged in banks of up to 5,000 kW capacity. A considerable number of these equipments have been delivered during 1949 and others are in process of manufacture at the firm's Walton-on-Thames works.

ELECTRICAL ACCIDENTS

Increase in total reported in 1948

AFTER steadily decreasing since 1943, the number of electrical accidents reportable under the Factories Act during 1948 showed an increase to 780, against 734 for 1947. Forty-three of these accidents were fatal, which, with 9 non-reportable fatalities and 99 electrical fatalities in places outside the scope of the Factories Act brings that total up to 151, an increase of 21 on last year's post-war low record. Reviewing these figures in "Electrical Accidents and Their Causes, 1948" (Stationery Office, 1s.), Mr. H. W. Swann, H.M. Senior Electrical Inspector of Factories, ascribes the rise to the great increase in the use of electricity in the production drive.

There were 23 successful cases of the restoration of consciousness by artificial respiration, including one where efforts were continued for more than 30 minutes. Thirty-one attempts at revival were unsuccessful.

Supply Industry

The year was marked by the assumption of control of electricity supply by the B.E.A. and its complementary boards, an event which has involved several new problems. One of these is the legacy of pre-war uncertainties in small companies about the prospective fault current of their bulk supplies. Existing switchgear is often inadequate, and the Senior Inspector recommends a review of all h.v. distribution systems and suitable use of reactances and sectionalisation pending replacement of the switchgear.

From the idea of consumer service adopted by the area Boards, hope is drawn for more cooperation in the matter of protection against short circuit, overcurrent and earth leakage. For instance, there should be more readiness to disclose the prospective short-circuit current at the consumer's terminals, and help should be available in ensuring reasonably low values of earth connection resistance, or free discussion of the implications of inability to do this should be possible.

Coming to accidents, two cases are mentioned where inductive rises of voltage, due to the circuit not being broken at current zero, caused dangerous flash-overs. This is a warning against too ready assumption of zero-current-breaking in a.c. switching studies. Another voltage rise phenomenon that has caused trouble occurs due to resonance when a capacitor p.f. corrected motor is switched out, the machine acting as an induction generator.

Once again several accidents are reported to have occurred in the course of h.v. maintenance work, and again the need for strict adherence to the "permit-to-work" scheme is emphasised.

An interesting fault, unfortunately resulting in injury to the operator concerned, resulted from an attempt to break a highly inductive 3 kV circuit on light load by means of plain air-break knife pattern isolators, in order to minimise interruption of supply. The inductive arc drawn when one isolator was opened flashed over to earth and to adjoining

phases, and the accompanying induced voltage caused flash-overs along the air-insulated sections of the busbars.

Industrial Applications

Note is made of the established use of conducting rubber in connection with static electrification. Although fairly high values, between 5 and 10 megohms, can be tolerated for the purposes of quick drainage, values below 100,000 Ω circuit resistance are inadvisable because of the associated fire risk if a heavy leakage current occurs. The use of non-inflammable synthetic rubbers reduces this risk.

Another innovation of recent years is the use of aluminium conduit. Where commercially pure aluminium is used throughout, experience and tests have shown that electrical continuity is maintained throughout and there is no corrosion. Experience with aluminium conduit and zinc base light alloy die cast fittings is still too slight to permit of any conclusion being reached.

That electrical accidents are not confined to electric shock cases is demonstrated by the number of instances of ignition of inflammable material reported. Many of these were due to the firing of vapour-air mixtures by push-button sparks or—in one case—from the bare ends of the lead into a vapour-proof fitting, which itself had been removed by a workman and left dismantled with lines live during his lunch hour.

Accidents to Electricians

241 of the reportable accidents (31%) involved electricians, and the reports of these occurrences justify some thought about their training in electrical safety. A common cause of accidents is still the view of electricians and fitters that they can perform minor adjustments without shutting down plant. Often the shut down resulting from the accident is many times as severe as that required to complete the repair properly.

Apprentice training always presents difficulties, as to give them experience and yet keep within the requirements of the Act, they must be employed as "authorised persons." Duty is in such cases placed on employers to see that they are only allowed to do work well within their abilities.

Attention is drawn to the shortage of electricians with sufficient technical training to trace faults in, and carry out maintenance of, electronic control gear. It is important to ensure that this valuable field of development shall not be prejudiced because of the failure of ill-considered applications or unreliable design. To this end the report includes some notes on common troubles. Contact difficulties are noted, the possibility of excess voltage with indirectly heated valves, and the common insufficiency of insulation levels for industrial situations is remarked.

Some topics are discussed with reference to normal electrical control gear, the first concerning contactor type motor control units. Some of these employ lightly spring loaded contacts, and these may close as the result of a blow with the hand, or even because of slight vibration of the case. Accidents have been caused from this characteristic, and from the analogous failure to shroud push type "start" buttons.

Portable tool accidents as usual occupy a section of the report, and include one case where neutral inversion was a factor in a fatal accident. Low voltage working for portable tools in temporary installations, especially on constructional jobs, is becoming increasingly common. At least one large consulting firm proposes to make the use of such low voltage a part of their specifications.

REPORTABLE ELECTRICAL ACCIDENTS IN RELATION TO APPARATUS, 1948

Apparatus	Fatal		Non-Fatal		Total
	Men	Women	Men	Women	
Electrical machinery ...	—	—	8	1	9
Transformers	—	—	2	—	2
Switchgear above 650 V	7	—	48	—	55
Switchgear below 650 V	1	—	117	4	122
Fusegear	3	—	56	—	59
Crane trolleys	3	—	17	—	20
Electric welding—					
(a) Shock and/or burns	1	—	15	2	18
(b) Eye injuries ...	—	—	152		152
Portable electric machines	12	—	51	2	65
Portable heaters and irons	—	—	4	2	6
Portable lamps ...	2	—	17	1	20
Fixed lamps	1	—	14	1	16
Plugs and adapters ...	1	—	25	1	27
Cables and flexibles—					
(a) Portable apparatus	4	—	42	6	52
(b) Fixed installations	5	—	66	2	73
Electrical ignition of inflammable materials...	—	—	2	—	2
Testing	—	—	50	—	50
Other apparatus ...	3	—	28	1	32
TOTAL	43	—	562	23	780
			Plus 152 eye-flash accidents (welding)		

Earthing

Once more the Inspector has much to say on this subject. The installation of earth leakage indicators at large factories can be a useful aid to maintenance as well as a safety measure, and the results of such an installation are often surprising for the number of existing earths revealed. Earth continuity is, of course, important, and this is tied up with the need for testing circuits regularly. In this respect it is noted that the method of injecting a current of about 10 amps into the earth circuit from a l.v. transformer for testing purposes is being increasingly commonly applied. Suitable instruments are now appearing on the market.

PROBLEMS and PRACTICE

In Engineering

Daylight Lighting

A REPORT was received that street lamps in a certain area were glowing dimly during the hours of daylight but lit with full brilliance at night. Investigation showed that this was so, the dim condition occurring when the time switch feeding the switch wire was open. To facilitate investigation the circuit breaker controlling the circuit concerned was opened but it was found that the lamps still glowed. As some of the lamps were fed from another substation that feeder was also opened, again without effect. On walking the route, however, it was discovered that whilst the two substations were not connected in parallel only one switch wire was being used for the whole length of the two feeders, some of the lamps being connected to the neutral of one substation and some to the neutral of the other.

Instructions were then given to test for an earth on any of the feeders radiating from either of the substations. Before tests could commence, however, a report was received that a lady, who had no electricity whatsoever in her house, had received a shock off a gas cooker. The search was immediately transferred to this point and it was discovered that a dead earth fault existed in the house adjacent, but as the earthing conductor was apparently in good order it was difficult to see why the fuses had not blown. Further enquiries, however, elicited the fact that the tap to which the earthing conductor was connected was not to the main supply but was fed from a small well a short distance away.

The run of the pipe was under the adjacent house which had a stone floor. It was whilst the lady of the house was scrubbing this floor that she touched the gas cooker and received the shock complained of.

Once this fault had been cleared the street lamps glowed no more. The fault current was, of course, returning to its source via the neutral of transformers A and B and passing through the neutral conductor of A, through both sets of street lamps in series and back along the neutral conductor of B.—*John Pugh.*

Bathroom Switch Fault

INVESTIGATIONS into complaints of shocks being felt from a domestic light switch led to the discovery of an unusual type of fault. The switch was of the type where two

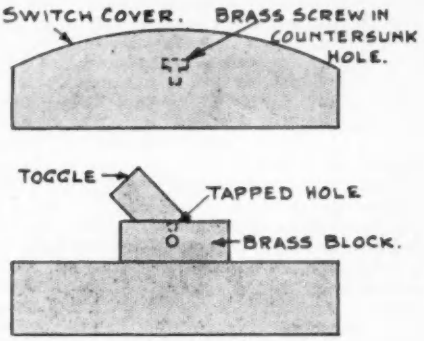
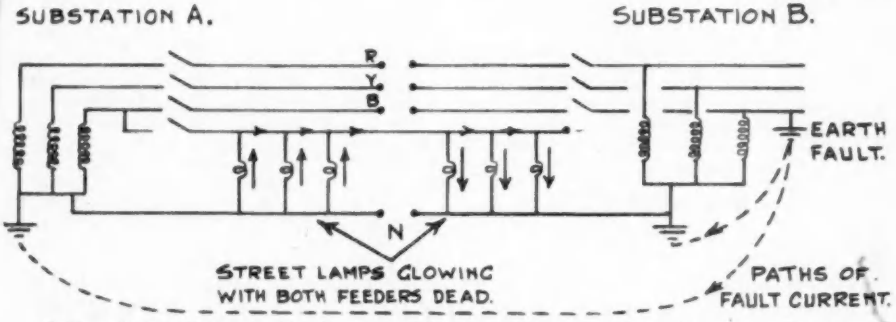


Diagram of faulty switch components

brass screws held on the plastic cover, these screws screwing into tapped holes in two brass blocks in the main body of the switch. These brass blocks were also drilled at right angles to the tapped holes to provide bearings for the toggle spindle, which was of metal, being insulated with sleeving where it fitted into the holes in the brass blocks. This insulated sleeving had, through the normal operation of

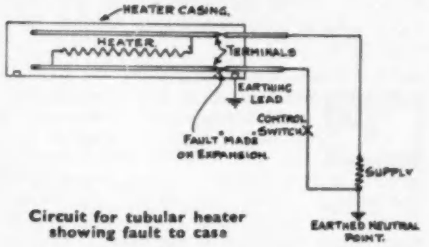


Cable and substation connections for street lighting installation, showing positions of earth faults

the switch, been worn bare at one end of the toggle spindle, and was no longer fulfilling its duty. Consequently, when the switch was on, one of the brass blocks was alive by leakage from the toggle spindle, and so was the brass screw which screwed into it. It only remains to say that the said switch was in a bathroom and it will be seen that dangerous results may have been experienced had the fault not been found. The rest of the switches in the house were found to be of the same type.—*J.H.H.*

Fault on Tubular Heater Circuit

ANOTHER example of careless house wiring producing a nice mystery problem which, however, might have led to unpleasant consequences, is shown in the following case. The irony of the whole thing is that the installation was considered a first-rate job because earthing precautions had been taken.



Circuit for tubular heater showing fault to case

A tubular heater had been installed beneath a nursery window and connected to the supply behind a standard 15-amp 3-pole socket mounted on the skirting board for normal use. The controlling switch was mounted outside the room away from interference by the children. All went well for some period until one evening the house owner on returning from business was greeted with "something has gone wrong with the heater in the children's room—it won't switch off." The only immediate action was to switch off at the main house switch and disconnect the heater from behind the socket.

Examination of the local connections to the heater showed that the heater casing was correctly earthed to that in the socket connection and the power connections appeared in order though not neatly done, the wires being just twisted under the terminal screws. On the face of it, nothing appeared wrong.

The problem was solved by considering the circuit diagram as shown in the sketch and deducing the probable errors as indicated.

An earth found in the heater occurred only after the heater had become hot, expansion of either the casing or one terminal box caused a wire strand on the terminal to touch the casing and so complete a circuit.

The installation was put in order by first changing the control switch from the neutral to the line and then remaking the connections to the heater using terminal flags and as an extra precaution, slipping over each terminal a short piece of rubber tubing to ensure complete insulation.

The accompanying diagram illustrates the incorrect connections and earth fault.—*D.C.H.M.*

Some Snags in Fault Location

IN the note by Mr. Bloggis printed last week under the above title, two errors occurred. In para. 3 "The test will fail if N_2 is near half . . ." should read ". . . if N_1 is near half."

In para. 7 "This corresponds to letting $N_2=\frac{1}{4}$ in the . . ." should read ". . . $N_1=\frac{1}{4}$ . . ."

Variable Voltage and Cable Faults

FURTHER to my note in the issue of December 29, it occurs to me that one point will bear a little amplification. I refer to the unstable nature of the fault resistance network or leakage mesh. The component arms partake of the nature of simple voltaic cells, and it is therefore to be expected that their effective resistance will vary with the polarity and magnitude of the testing voltage and its time of application.

Thus, the values determined by an Avometer, for example, might differ considerably from those obtained with a 500 volt Megger. Whichever arm is measured, it is always shunted by the other two in series, a fact to be borne in mind when dealing with relatively low fault resistances, such as the ones under review.

From the foregoing, it follows that the bridge or slide wire balance is liable to continual variation, a condition which the experienced tester will realise demands patience and skill to ensure a successful localisation.—*J.L.G.*

Tracing Motor Volts

THIS incident may be termed a leg pull. The complaint concerned a 460 V d.c. motor, which would not work. I was informed that following a break in supply the lights had come on but not the motor. I suspected one outer to be still off, but was a little disconcerted to find (with the usual electrician's test lamp) that both outers were alive to neutral.

The situation was the same at the motor controls, but the motor was as dead as the proverbial door nail; so dead that a high resistance connection was ruled out. There was only one thing for it although it was my only experience of this fault. I rigged up a second test lamp and tested across the outers, the result being—no light. Both outers were the same polarity!

Was I pleased to ring up the mains department!—*George H. Currie.*

Contributions to this page, dealing with specific problems and items of interest to practical engineers are welcome, and will be paid for at our standard rates. Items should be brief, and preferably accompanied by diagrams or sketches which will be redrawn for publication.

OVERSEAS NEWS

Australia's Industrialisation

A recent survey compiled by the Australian Division of Industrial Development shows that the horse-power installed in factories in the Commonwealth has increased from 1·2 million in 1936-37, to 2·3 million in 1946-47, an increase of almost 100% in ten years. As a further indication of the growth of load, the total electricity generated throughout the Commonwealth during the month of March last was 784 million units, compared with a monthly average of 697 million units during 1947-48. Despite this spectacular increase, the degree of mechanisation in Australian industry is low compared with some other countries. To meet the demands of industry, much new generating plant and other equipment will be required over the next ten years. The survey records that new generating plant to be installed throughout Australia up to 1957 will involve a total expenditure of £194,267,000, increasing the present capacity from 1,978 MW to 5,895 MW.

Eildon Dam Work

Tenders are shortly to be called for the construction of an additional 12 ft on the retaining wall at Eildon Dam, Victoria, thereby increasing the storage capacity to 2,750,000 acre-feet. It will also provide increased output of electric power from the generating station at Eildon Weir.

Boilers for Adelaide

Two more boilers, each of 40,000 lb/hr capacity, are to be installed at Osborne "A" power station of the Electricity Trust of South Australia. These will allow full use of the generating plant at the "A" station, to cope with the demand till the extension to the "B" station is complete. The new boilers are designed for the use of low-grade coal, such as that mined at Leigh Creek.

Supply Trouble

Consumers in the little town of Port Broughton, South Australia, were notified by the local supply company that power would cease as from January 1. Apparently, the company, which had been operating since 1926, wished to sell its plant, but the district council and the Electricity Trust thought the price asked was too high. Following representations, the company has agreed to continue the supply till the end of February. Meanwhile, investigations are being made concerning the possibility of obtaining an alternative supply.

Tasmania Transport

Until the population and production of Tasmania increased, the large capital expenditure involved in electrification of railways could not be justified, the State Commissioner for Railways declared at a meeting last month. Parliament had already approved an expenditure of nearly £3,000,000 for modern rolling stock and the Commissioner had developed further proposals which would involve spending another £700,000 on rehabilitating passenger rolling stock and track improvements. Although he had considered the matter of electrifying portions of the system, he was of the opinion that diesel electric locomotives would give many of the advantages of electric traction without involving the heavy capital expenditure which would be necessary to provide complete electrification. In planning future developments, however, the possibility of electrification of at least the major sections of the railway system at some future date was not being overlooked.

Bridge River Increase

The third 62,000 h.p. generating unit at the Bridge River development of the British Columbia Electric Railway Co. was put into operation recently making the station the largest single hydro-electric generating station in Western Canada. The Bridge River project now has three units of the same size in operation, a total of 186,000 h.p. Eventual capacity of the plant is estimated at 620,000 h.p. At the inauguration ceremony, the president of the company said it was planned to add, in 1950, a further 47,000 h.p. at the Ruskin plant to the undertaking's generating capacity.

B.C. Survey

Engineers of the British Columbia Power Commission are now undertaking a survey at Clowholm Falls with a view to a possible power development. It is believed that about 12,000 h.p. would be developed at the site.

Quebec Extensions

The Shawinigan Water and Power Co. has completed a new transmission line from Three Rivers, Quebec, to La Tuque, which will ultimately be extended to connect up the company's new Trenche generating station on the St. Maurice River. This plant, of 325,000 h.p., should be in operation in 1951.

Television in Canada

The chief engineer and coordinator of television to the Canadian Broadcasting Corporation stated recently that Montreal could expect a complete television service by midsummer in 1951.

Canadian Export Control

The Canadian Trade and Commerce Department has announced the removal of a number of items from export control. Among the goods

covered are non-ferrous conduit and cable, and metal drums, it is reported.

Swiss Lamp Trade

With the increasing local production of electric lamp bulbs, the importation of such goods into Switzerland will further decline in the next few years, Swiss trade circles maintain. Apparently a reduction in the quantity of lamps imported has already been noticed. Another factor hampering imports is the recent decline in Swiss export of bulbs making available larger domestic supplies to the home market. Only 572,000 francs worth of bulbs were exported in the first eleven months of 1949 as compared with 647,000 francs worth exported in the corresponding period of 1948. The local industry now has available sufficient raw materials to meet all requirements, and only high quality well-known foreign brands can still find a market in Switzerland, it is stated. Generally speaking the foreign product is considered to be of lower quality than Swiss goods. Recent trial purchases of U.S. and U.K. manufactures have not brought forward any orders, although prices were below the Swiss market level.

Indians to visit Japan

A technical commission is shortly to leave India for Tokyo, to examine the feasibility of the Indian Government placing orders for electrical machinery in the Far East. With the cut in expenditure on long-term projects due to financial difficulties, the Indian Government has found it necessary to slow down the execution of the schemes unless the necessary machinery could be obtained at reduced cost. The Japanese trade and technical delegation which recently visited India, offered to supply India with electrical plants within the terms of the Indo-Japanese trade agreement at competitive prices, promising early delivery of goods.

Madras Nationalisation

Last month the Madras Provincial Legislative Assembly passed the Bill providing for the nationalisation of all electricity supply undertakings in the Province. It is estimated that total compensation to be paid by the Government will amount to Rs. 35 million. The Minister for Public Works stated that by 1952, when the five year plan of electricity development now under way was expected to be completed, generating capacity would be doubled.

Milking Demand

Doubling up of milking machines had increased the instantaneous peak demand for electricity, and placed a great strain on line and transformer loading with little or no increase in the number of units consumed, said the chief engineer, Mr. G. P. Lindsay, at the recent meeting of Thames Valley Power Board, N.Z. The practice had developed widely, and was causing concern to power boards throughout Waikato, for whom protection was essential, he said. The problem is to be discussed at the Board's next regional conference.

Mr. Lindsay suggested the imposition of a system of penal rates such as that of £6 per h.p. on all motors exceeding 2 h.p. imposed by another Board. Mr. R. Sprague, the manager, said the Board had standardised on 1½ to 2 h.p. motors for milking plants, but with the introduction of new methods the size of motor required would be not less than 3 h.p. This would adversely affect the peak demand.

Underground or O.H.?

The chairman of the Auckland Electric Power Board, Mr. C. J. Lovegrove, has now suggested that the Board should adopt a long-term policy to place all distribution lines underground. Like other New Zealanders who have been overseas, Mr. Lovegrove was amazed to see what had been done in preserving the amenities in England. He does not think that public opinion in New Zealand will always tolerate the ruthlessness now shown to trees and hedgerows, and in this assumption he is probably correct. He suggests that the scheme for the alteration of the distribution system should be spread over twenty years.

Gold Coast Survey

A party of engineers from Sir William Halcrow and Partners left London by air last week-end for the Gold Coast, where they are to investigate the potential power available from the Volta River. The Gold Coast's longest river, the Volta, is a mile wide at Ada, where it flows into the sea. This general survey is to have particular reference to hydro-electric power at Ajena and/or Bui, in addition to irrigation and the provision of port facilities. It will be recalled that Mr. Peter A. Scott carried out an initial survey of the Volta basin last summer, as we recorded.

Large Stokers

The ten mechanical stokers to be made by the South African subsidiary of International Combustion, Ltd., would be the largest in the world, Sir George Usher stated recently. These stokers are for the Union's new power stations at Pinetown (4), and Vierfontein (6).

St. Lawrence Scheme Rejected

The official examiner of the U.S. Federal Power Commission has rejected the application of the New York Power Authority for sanction to the development of power works on its side of the St. Lawrence River. As a result, it would seem that there is little likelihood of the early acceptance of proposals for joint completion by Ontario and New York of power schemes of the St. Lawrence seaway project.

PERSONALITIES

In the Industry

Previously Midlands area manager for Newman Industries Ltd., and latterly Hopkinson Electric Co., Ltd., **Mr. E. C. Moxon** is now Midlands Electricity Board area representative for Elexcel Ltd. He may be contacted at 115 Warwick Road, Birmingham 27. Telephone: Acocks Green 2986.

On his retirement at the end of last month, **Mr. A. R. Harrison,** for thirty years secretary of Cryselco Ltd., was the recipient of a presentation from his colleagues.

Formerly manager of the West Cornwall Central district (No. 5 Sub-area) of the South-Western Electricity Board, **Mr. A. G. Parsons,** M.I.E.E., has now taken up the position of commercial manager of the Bristol Central District (No. 1 Sub-area). Born in Birmingham, Mr. Parsons served with the Shropshire, Worcestershire and Staffordshire Electric Power Co. and the South Wales Electric Power Co. before joining the Cornwall Electric Power Co. in Truro in September, 1941. He is succeeded as manager of the West Cornwall Central District by **Mr. J. H. Loukes.** Prior to leaving Truro recently, Mr. Parsons was the recipient of a presentation made by Mr. Loukes on behalf of his colleagues.

Mr. J. Oldham, O.B.E., J.P., chairman of Oldham and Sons, left last Thursday for South Africa, where he will be joined by the company's financial adviser and the chief engineer.

Mr. P. Dew has been appointed joint managing director of S. Guiterman and Co., Ltd., in succession to **Mr. A. R. Heath** who has vacated that position but remains a director and is retained as a consultant.

At present Dean of the Faculty of Electrical Engineering at University College, London, **Prof. H. E. M. Barlow,** Ph.D., B.Sc.(Eng.), M.I.E.E., A.M.I.Mech.E., has been appointed to the Pender Chair of Electrical Engineering tenable at the College from October 1 next. Prof. Barlow has been Professor of Electrical Engineering there from 1945 until October last, having originally joined the College in 1923, and serving continuously ever since, apart from the war years when he assisted the T.R.E. of the Air Ministry. In his new office, Prof. Barlow will succeed **Prof. R. O. Kapp.**

Prof. H. E. M. Barlow

On Thursday next, **Mr. A. E. Norris,** director and sales manager of J. G. Statter and Co., Ltd., leaves this country by flying-boat for Egypt. After a brief stay there he will proceed to Nairobi, Salisbury, Bulawayo, Johannesburg, Port Elizabeth, etc. in that order. He is to stay at each of those cities for a short time for discussions with the company's representatives, and interested firms or individuals can contact him by writing to him c/o H.M. Trade Commissioner at those places. Mr. Norris returns to England from Capetown on April 7 in the *Winchester Castle.*

Mr. A. E. Norris

South Africa and Southern Rhodesia is also to be the trade hunting ground for the next few months of **Mr. R. A. Erskine,** M.A., M.I.E.E., chairman and managing director of Erskine Heap and Co. He leaves this country today, January 12, in the *Winchester Castle.* During his tour he hopes to cover nearly 10,000 miles, visiting existing and potential customers. He expects to return in about four months' time.

Two members of the staff of the Canadian Standards Association arrived in this country last week-end. They are **Mr. W. C. Cale,** an approvals engineer, and **Mr. J. O. Reeve,** another engineer on the Association staff. They are to co-operate with the British Standards Institution in starting the scheme for the testing in this country of certain electrical equipment intended for the Canadian market.

The General Electric Co., Ltd., announces the retirement at the end of last month of **Mr. A. A. Hooper,** registrar of the company since 1918. He is succeeded in that position by **Mr. W. J. Druce,** formerly chief assistant to Mr. Hooper.

For the position of head of the Department of Engineering at Reading Technical College, **Mr. P. E. Hawes,** B.Sc.(Eng.), has been selected. Since 1943 he has been deputy head of the engineering department of the School of Technology, Oxford. Educated at Latymer School, Edmonton, and Queen Mary College (University of London), he afterwards spent eight years in the automobile industry, mainly as chief assistant technical engineer to the B.S.A. Co. He entered the teaching profession in 1935 as an assistant lecturer, holding that position at Oxford, Coventry and Ipswich until returning to Oxford in 1943.

Mr. A. Duke, who is well known in the Birmingham area where he spent ten years as a lamp representative and sales engineer, has joined the lamp sales organisation of Thorn Electrical Industries, Ltd.

Mr. D. Scott has joined Thorn Electrical Industries, Ltd., as lamp sales representative for the Salisbury, Southampton, Bournemouth and Dorset area. Mr. Scott previously represented Wm. Dibben and Sons, Ltd., of Bournemouth.

Until recently with the English Electric Co., Ltd. **Mr. P. T. Davies,** B.Sc.(Eng.), A.M.I.E.E., has been appointed general manager of the Cardiff factory of Hopkinson Electric Ltd.

The new secretary of No. 2 (Newbury) sub-area of the Southern Electricity Board is **Mr. J. W. K. Evans,** B.A., who was previously with the Merseyside and North Wales Electricity Board.

To succeed Mr. G. D. Johnstone, the Midlands Electricity Board has selected **Mr. D. Holt,** B.Sc. (Tech), M.I.E.E., as manager of the Central Gloucestershire sub-area. Mr. Holt has been manager of the Wolverhampton district since April last, having previously served in a similar capacity at Walsall. He was, of course, engineer and manager of the latter corporation undertaking prior to vesting day. Born at Birkenhead, Mr. Holt was educated and trained at Manchester University and with the Rochdale Electricity Supply Department. He was appointed assistant engineer of the latter undertaking in 1923, and in 1930 became assistant mains superintendent. Three years later he joined the Walsall undertaking, first as district engineer, then as mains superintendent, as chief assistant engineer and as deputy engineer and manager. He became chief there in 1946.

On Thursday next, January 19, **Mr. G. P. Sutton,** A.M.I.E.E., retires from the position of chief generation engineer (operation) to the Midlands Division of the B.E.A., after 51 years' service in the electrical industry. Prior to his present appointment he served the City of Birmingham Electric Supply Department for nearly 42 years, rising from junior engineer at the Summer Lane station to generating stations engineer, at which time he was responsible for the operation of all their generating stations and the Birmingham system control. Mr. Sutton will now be able to devote more time to his hobbies—entomology and horticulture—he is president of the entomological section of the Birmingham Natural History and Philosophical Society. We wish him a long and happy retirement.

Mr. G. P. Sutton

To fill the position of chief generation engineer, operation, the Midlands Division of the B.E.A. has nominated **Mr. F. W. Skelcher,** A.M.I.E.E., A.M.I.Mech.E., who is now generation engineer (op.), Southern group, to that Division.

At the recent board meeting of Newton Brothers (Derby) Ltd., **Mr. F. V. Pipe,** A.M.I.E.E., formerly managing director, was elected chairman also, in succession to **Mr. P. C. Cooper-Parry,** O.B.E., M.C., J.P., F.C.A., who has resigned for health reasons. In addition, **Mr. G. Smith,** F.C.A., was appointed a director. Mr. Pipe, who now becomes chairman and managing director, was earlier associated for many years with the B.T.H. Co. at Rugby and Coventry. He joined Newton's in 1918 as works manager, and subsequently became, in turn, London manager, general manager, director, and, for the past eleven years, managing director. He is also a member of the East Midlands Electricity Consultative Council.

Mr. F. V. Pipe

We learn from Elexcel Ltd. that **Miss A. E. Wolley** has been appointed senior demonstrator. She was formerly with the Shropshire, Worcestershire and Staffordshire Electric Power Co., now the Midlands Electricity Board, as housecraft adviser for the Southern Division.

The appointment of **Mr. L. Armstrong** as a sales representative in Derby and Nottingham is announced by Ekco-Ensign Electric Ltd. He may be contacted at the Ekco-Ensign Nottingham Depot, 57 Hounds Gate, Nottingham (Tel.: Notts 45862).

Mr. Ashley S. Ward, who has been chairman of Thos. W. Ward Ltd. since 1941, has resigned from that office. He remains a director, however, and will act in an advisory capacity. In recognition of Mr. Ward's many years of service, the company have appointed him president. **Mr. G. Wood** has been appointed chairman and **Mr. F. R. Stagg** deputy chairman; **Mr. H. W. Secker,** O.B.E., and **Mr. J. Walton** become joint managing directors; and **Mr. A. Carr,** hitherto in charge of London area operations, is to transfer his activities to Sheffield. In addition, **Mr. F. W. Robinson,** a local director, has been appointed to the full board of the company and will take charge of London area interests vice Mr. Carr.

Formerly on the North Staffs Sub-area staff of the Midlands Electricity Board, **Mr. J. Walters,** A.C.I.S., F.S.S., has secured an appointment as statistical section head at the No. 5 Sub Area headquarters of the North Western Electricity Board. Earlier he had been senior assistant (consumers) in the Stoke-on-Trent Electricity Department.

Until recently traction engineer with British United Traction Ltd., **Mr. E. A. Aust** sailed for India last Thursday to take up the post of executive engineer with the Calcutta Tramways Co., Ltd. He served as an apprentice with the B.T.H. Co. prior to joining the Shanghai Tramways Co. in 1938 as electrical engineer. In August 1942, after eight months under Japanese occupation he was repatriated and subsequently obtained a commission as electrical lieutenant V.R. with the R.I. Navy, later becoming Naval Port Electrical Officer, Calcutta, and in September 1943, promoted Electrical Lieut.-Commander. He came to England early in 1946, but went out to the Far East again in 1947, returning to this country in April last.

Mr. E. A. Aust

Recently appointed assistant controller (engineering) in the Department of Telecommunications, Federation of Malaya, is **Mr. R. J. Pickard,** B.Sc. (Eng.), A.M.I.E.E., who has served with the G.P.O. Engineering Department since 1939.

Mr. Clive Pearson, who is retiring for personal reasons from some of his business responsibilities, has resigned from the board of Whitehall Electric Investments as from December 31, 1949. It is proposed that he shall be succeeded in the chairmanship by **Viscount Cowdray.**

In succession to **Mr. J. G. Gellion,** who has retired owing to ill health, the Wardle Engineering Co., Ltd., has appointed **Mr. J. P. Devlin** as manager of the Birmingham area.

OBITUARY

We note the recent death of **Mr. T. H. Varese,** A.M.I.E.E., manager of the Birmingham branch of Siemens Electric Lamps and Supplies Ltd. American by birth, he joined Siemens Dynamo Works Ltd., in 1912, as sales engineer at Birmingham. Two years later he became manager of the Supplies Department there, and on the formation of the present company in 1920, was appointed manager of the Birmingham branch.

It is with regret that we record the death, on December 31, of **Mr. A. M. Niven,** A.M.I.E.E., aged 72, a senior member of the staff of Bruce, Peebles and Co., with whom he had served for over forty years. He was honorary secretary and treasurer of the Edinburgh Electrical Society for many years.

The death occurred on January 4 of **Mr. G. C. Hadfield,** manager of the electricity showrooms, Smithy Row, Nottingham, for the past 29 years.

We regret to record the death, on January 2, of **Mr. C. C. Atchison,** M.I.Mech.E., M.I.E.E., who was primarily responsible for the launching of the electricity undertaking of the Warmley R.D.C. He had at other times served as engineer-in-charge with the Metropolitan Electric Supply Co., and as electrical and tramways engineer to Rochdale Corporation.

We note the death, on December 31, of **Mr. N. Greening,** assistant managing director of N. Greening and Sons Ltd.

We note the death, on December 23, of **Mr. A. Hopwood,** A.R.C.S., A.M.I.E.E., F.R.I.C., aged 75, who had been successively principal of the Carlisle, Portsmouth, and Tunstall Technical Schools.

The death occurred on December 29 of **Lt. Col. Sir Henry McMahon,** who was chairman of the Oriental Telephone and Electric Co., the China and Japan Telephone and Electric Co. and other concerns.

NEW LITERATURE

Lighting Technique

by B. F. Federov

TRANSLATED from a Russian standard text book, this volume provides a general course in the subject for electrical engineering students at about degree or Higher National Certificate level. A mathematical approach is used throughout, but this is relieved and supplemented by many references to practical considerations and to applications and to current practice in the Soviet Union when the original book was written (1944).

Early chapters deal with fundamental concepts, measurements, with typical light sources and with the principles of lighting fittings.

For the British edition a section on fluorescent lighting has been added, written by Mr. W. O'Dea. Published by Hutchinsons' Scientific and Technical Publications Ltd., 300 pages, 8¼ in. x 5¼ in. Price 25s.

Industrial High Frequency Electric Power

by E. May

AS an introduction to the industrial use of high frequencies, this book serves its purpose well, since it gives an outline of the theory and applications of induction and eddy current heating with frequencies ranging from power level to the v.h.f. range, and also deals with generators of the three main types, spark, rotating machine and valve.

The book is concisely written as must be the case when such a wide field is covered, but the principles are none the less clearly and logically outlined. An extremely useful list of references to the subject is provided, enabling the reader to delve more deeply into subjects of particular interest. Published by Chapman and Hall, 355 pages, 8¼ in. x 5¼ in.

NEW PLANT IN 1949

B.E.A. Ends Year with Record Installations

UNLIKE its financial year, which operates from April to March 31, the B.E.A.'s plant year is a calendar one. Thus December saw the end of the first full year of constructional activity under the Authority's control, and a review of the progress made becomes appropriate. It may be said at once that targets, except that of the over-optimistic economic survey for 1948, have been reached with the achievement of a total of 825·5 MW of new turbo-alternators installed.

December was a notable month for plant commissioning, for 308 MW of turbo-alternator sets are noted as coming on load during that period, so concentrating 26·8% of the year's increase into 8·5% of its total duration. In addition to the turbo-alternators, boilers with a steam raising rating adding up to 2291 klb/hr were installed. Altogether 11 stations were concerned in these changes.

In the London Division is the new West Ham "B" station, where a 30 MW English Electric set has been installed. The first of four to be installed in this 180 MW ultimate capacity station by 1952, this set is at present supplied

Month	Plant Installed
January	22·5 MW
February	3
March	65
April	0
May	52
June	190
July	0
August	60
September	75
October	50
November	0
December	308·5
Total	825·5

by one 180 klb/hr John Thompson boiler, working at 640 lb/sq in., 875° F.

The Kingston "B" station, which was opened in October, 1948, has had another, 30 MW set (BTH) commissioned, thus completing the programme for generating sets there, as at present announced.

Cliff Quay, in the Eastern Division, continues to grow in size, and December brings the announcement of another 365 klb/hr boiler (Babcock and Wilcox), this making four since May of 1949, out of the six programmed to be in place by the end of 1952. This station uses steam at 600 lb/sq in., 850° F.

At Freeman's Meadow, Leicester—(East Midlands Division) one half of the authorised extensions to this 89·25 MW staion were completed with the commissioning of one 31·5 MW Richardsons Westgarth-Brown Boveri machine and two International Combustion 175 klb/hr boilers. Nearby, at Nottingham, in the same division, progress has been made at the North Wilford station with the fourth section of the station by the installation of a 53 MW BTH set.

The bordering Midlands Division has also had two stations extended in this December rush. Hams Hall "B" is the larger, and there the 320 klb/hr International Combustion boiler installed leaves only one similar unit for commissioning to complete the "by 1953" programme. The other station, Walsall, has both set and boiler to note. The former is the third 30 MW BTH machine to go on load in the station, which was opened last September, while the 150 klb/hr, 650 lb/sq in., 875° F. Babcock and Wilcox boiler installed is the fourth, out of a projected twelve.

Further north comes the Yorkshire Division, with the Prince of Wales station at Rotherham. Plans for this station envisage the doubling of its size, and a first step was taken with last month's total of a 50 MW Parsons turbo-alternator and two 200 klb/hr International Combustion boilers. Also in the Division is the Bradford station, where the 180 klb/hr Babcock and Wilcox unit completes the authorised extensions to boiler plant. Steam conditions are 650 lb/sq in., 850° F.

Finally comes Kearsley power station, situated near Manchester, in the North-Western Division. New plant has been commissioned here steadily during the year, and in December a good finish was achieved with a 52 MW BTH set, and two 173 klb/hr Babcock and Wilcox boilers.

What Capacity?

One word of warning is necessary about this new generating capacity, in so far as it applies to turbo-alternator sets. The total given in the table will not be obtained by subtracting the stated installed generating capacity at the end of 1948 from that at the end of 1949; the number so obtained will be found to be smaller. Two main reasons exist for this. Firstly, during the year some plant has had to be taken out of service because it can no longer be usefully operated. Secondly—and this is responsible for the greater part of the discrepancy—existing plant is periodically "written down" in effective generating capacity because of the ageing of auxiliaries, etc. Nevertheless the listed generating capacity of the B.E.A., on a "sets connected to busbars and steam range" basis, rose from 13,004 MW to 13,117 MW.

MAGNETOS for AIRCRAFT

High Altitude performance presents Special Problems

IGNITION apparatus is of prime importance to reliable engine operation, and so outstanding care is particularly necessary in the design of systems for aircraft. In a paper read before the I.E.E. Utilisation Section last Thursday, MR. R. T. COE, M.A., M.SC.TECH., M.I.E.E. and MR. D. F. WELCH, M.A., A.M.I.E.E. (both with B.T.H.) considered one aspect of the subject under the title "Some Problems in Aircraft Magneto Development."

They began their paper with a consideration of the engine requirements and of the principles of operation of the elementary magneto. Highest voltage is required at take off. Operation must be satisfactory at temperatures between 40° C. (for a short period) and 110° C. (for extended periods). Voltages up to 15 kV may have to be generated without any internal flashover.

Simple Theory

Simple magneto theory gives a rectangular shape to the flux wave-form. This is not easily obtained, and in practice sides and corners are curved even under no-load conditions. Under working conditions further disturbances occur. Moreover, while the elementary theory equates electromagnetic energy before contact breaker operation to electrostatic energy afterwards, tests show the latter quantity to be apparently larger. The Authors consider that false assumptions about circuit inductance and maximum current measurements lead to this anomaly. All these departures from simple theory are inter-related, and depend upon such unpredictable features as pole tip flux. Thus magnetic circuit design has to rely mainly on experience and empiricism.

Having covered these basic points, Messrs. Coe and Welch gave most of their attention to contact breaker construction and operation, the altitude problem and the magneto transformer, taken in that order.

Contact Breaker Problems

A contact breaker has to keep the contacts closed with minimum bounce, open them cleanly at the appropriate firing angles and function for long periods without attention, but without much change in timing. Contact bounce, considered first, is detrimental since it increases contact wear; it is due to the kinetic energy of the contact upon closure, which is itself a function of the closing cam slope (i.e. decrease in contact gap per degree of cam rotation). Reducing of this parameter by decreasing the standard gap from 0·012 in. to 0·009 in. has been found helpful. The replacement of Duralumin double-arm levers by lighter, single-arm, units made from synthetic resin-bonded fabric has also proved successful, the damping action of the fabric helping.

Damping can be even more helpful in suppressing resonance of the contact-pressure flat spring resonance at certain engine speeds. A short reinforcing spring at the end can also stop this troublesome happening. Another point of mechanical design to be watched is the reduction of heel wear on the contact breaker (which retards the spark timing). Small radiuses on working surfaces are necessary to keep this down.

The electrical operation of contactors is still largely a question of choosing the right contact materials. Platinum alloys are good when the maximum initial rate of rise of voltage does not exceed 8×10^6 V/sec.; tungsten is a bad material electrically but has the advantage of giving consistent wear rate even under conditions of extreme contamination. The loss of energy at the contacts, however, is much greater than with platinum alloys, and an allowance must be made for this.

With any contacts there are two common forms of faulty circuit-breaking. There are "restrike," when the contacts spark over after opening, so dissipating the energy stored in the interim, and "current draw," in which the contact breaker fails to break the circuit initially and an arc is formed. The former fault can reduce spark energy by as much as 50%, but will only retard timing by 100 microsec., while the latter defect has little effect on energy, but may delay firing for as much as 600 microsec—11 engine degrees at 3,000 r.p.m.

Altitude

As altitude increases, the air gap that can be broken by a given voltage also goes up, becoming 0·7 in. for 10kV at 40,000 ft., compared with 0·13 in. at sea level. Unwanted flashover to a segment in the distributor is very liable to result from the ionising effect of the previous spark. Limiting the post-spark current duration by special transformer design helps to delay the appearance of this fault, while another expedient adopted is to increase air pressure by the use of gear-type air pumps.

To reduce the correct-path breakdown voltage, and so avoid incorrect breakdown a high permittivity insulating sleeve is used to

surround the end of the distributor brush. At 1,500 r.p.m. and 25,000 ft. this device reduces the voltage from 8·25 kV to 5·85 kV. A hard sintered aluminium-oxide material was found to be best for the purpose. Wrong-path breakdown has been found to depend on two main factors: inter-electrode spacing and the presence of post-spark current.

Transformer Design

Theoretical investigations into magneto transformer design are based on the neglect of losses and the assumption that the secondary voltage is produced by interrupting a steady current in the primary winding. The results must be viewed against the chief design requirement, which is that it shall be easy to modify primary and secondary voltages as required. The Authors have accordingly solved the appropriate equations for given voltages and primary current.

For normal design four sets of curves are required. These are: frequency of l.f. component (useful when regulation or high sparking speed are predominant factors), frequency ratio of the two components of voltage for various coupling coefficients, as a function of primary and secondary L.C. ratios, the transformation efficiency and the primary voltage per amp broken. Detailed design is best left until a prototype has been built, since different magnetic circuit assemblies and main casting arrangements influence losses to an unknown degree.

For conventional transformers the coupling coefficient is about 0·97, and the dissipation of post-spark energy is controlled by the R/L ratio for the secondary circuit, R being a complex ratio governed by two discharge phenomena. Experience has shown that for input energy not greater than 60 millijoules the maximum secondary inductance is about 16 H for a 40% closed period with 300 sparks/second. The output itself is limited by the electrical loading permitted on the contact-breaker, which for the speed quoted is 12 kV for platinum contacts and 10 kV for tungsten.

Various methods have been tried for acceleration of the dissipation of post-spark energy, and series resistances, series gap in secondary circuit and series capacitor are amongst those noted as not alone successful. The use of a reduced coupling transformer to increase the R/L ratio by reducing the secondary inductance has been found very useful, coupling coefficients from 0·74 to 0·8 being obtained.

The magneto with separate transformer has been tried with some success. Energy is supplied from a l.v. winding situated on the magnetic circuit of the generator. For practical purposes energy transfer efficiency is less than with the conventional magneto. Nevertheless, it has been found that the separate-transformer magneto is capable of higher sparking speeds or higher output energy per spark than the combination of reduced coupling transformer and rotary series gap.

In the final section of their paper, the Authors discussed capacitor discharge systems.

DISCUSSION

DR. E. A. WATSON (Lucas) was glad to find that the whole of the ignition industry were now in agreement about using the well-known type of contact breaker. He thought that the work of the authors might soon come to a stop because the gas turbine would take over for high altitude work.

MR. R. H. WOODALL (Rotax) said that present-day magnetos suffered more from mechanical than from electrical defects. Tungsten contacts were outstanding among electrical troubles. He mentioned the separate transformer scheme with the l.t. end carried to within 12 in. of the plug as eliminating altitude troubles.

MR. W. R. DEBENHAM (R.A.E.) quoted the improvement effected by the use of ceramic sleeves on semi-circular distributors for Merlin engines was from 20,000 ft at 5 kV in 1938, to 43,000 ft at 5 kV in 1942-43. The theory of ignition was still a controversial subject, and certain improvements in engine running secured with an increase in discharge duration supported Professor Finch's conclusion that ignition was mainly due to the first half-cycle of the inductance component.

MR. A. H. MITCHELL (R.A.E.) described experiments performed to correlate the various methods of measuring the primary inductance with the output voltage wave form.

MR. H. E. WEST (Rolls-Royce) spoke of the difficulty of lubricating the contact breaker, which was running at very high speed, and at the same time preventing the lubricant from getting on to the points. Rolls-Royce's experience with tungsten, he said, had been very satisfactory, and the firm's magnetos could never have run with reliance on platinum. Tungsten contacts quickly cleaned themselves and established an electrical surface.

MR. E. E. ROBINSON (Rotax) referred at some length to an inductor type of magneto generator, with which a considerable improvement on the open circuit flux waveform achieved in practice could be obtained. It was characterised by a wide rotor pole arc and very narrow stator poles, the construction allowing the choice of optimum dimensions for the magnets. With a peak value of 15 kilolines of flux, one could obtain the same output, other considerations being equal, as with a normal flux wave with a peak value of 20-22 kilolines. Post-spark energy was considerably reduced with this system.

MR. E. YOUEL (R.A.E.) thought that too much emphasis had been given to post-spark current duration. From tests, he thought that ionisation in the distributor intersegmental spacing continued after the spark went out. High tension series resistors produced less improvement in altitude performance than would be expected if the post-spark duration had all the importance which the authors attached to it.

GLARE

— and the lighting engineer

IT has long been recognised that good lighting means much more than a high level of illumination, and that freedom from glare is of considerable importance. In this climate large areas of white cloud reach an uncomfortable brightness level, and the glare problem is not confined to artificial lighting alone, but is an important consideration to the architect.

The paper read by P. Petheridge, B.Sc. and R. G. Hopkinson, B.Sc. (Eng.), Ph.D., M.I.E.E., before the Illuminating Engineering Society on Tuesday of this week, describes and interprets experimental work which included the glare problems of windows. Previous research by other workers has shown that discomfort arising from a small source of glare depends primarily on the intensity and not on brightness alone, while from a large source it depends both on intensity and brightness, the latter becoming increasingly significant with the apparent area of the source. Simplified expressions obtained from previous work could not be applied to windows so that further experiment was necessary.

Method Adopted

The essential feature of the apparatus is that the observer looks into a model room against a glare source which is represented by a condenser lens. In front of this is a photograph of, say, a room with apertures cut out to represent light sources. The photograph which appears to be lit by the glare source is actually separately illuminated, so that both glare and apparent illumination can be varied independently.

Classification of glare into four criteria was carried out by six observers all experienced in the technique of subjective appraisals. The criteria were A—just intolerable; B—just uncomfortable; C—just acceptable; D—just not perceptible, where the sources merge into the general field of view.

Results

Results confirm the findings of previous study in that discomfort depends on source brightness, intensity, and apparent area; the displacement of the source from the general direction of view; (C) the general brightness of the surroundings. It is important to note that the surround brightness is that of the general surround, i.e. that responsible for eye adaptation rather than the immediate surround of the glare source.

The complete data obtained is very extensive, and the results discussed have been confined to general trends. One of the important conclusions drawn from the studies is the distinction between discomfort glare and disability. Discomfort is confirmed as a function of source brightness, whereas disability is independent of brightness. Furthermore, small displacements of the source from the direction of view affect disability much more than discomfort.

Application to Design Problems

The complexity of the glare problem is such that any form of condensation is apt to be misleading if used without adequate knowledge of the subject as a whole, but it is possible to give some useful generalisations.

Table 1 gives values of source brightness and general environment brightness for an installation fairly typical of present practice. The two right-hand columns give the probable general background brightness in a room 12 ft high with light walls and ceiling, and with one light fitting to each 100 sq ft of floor area.

Table 2 is calculated from table 1.

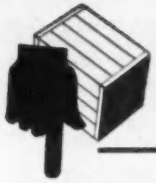
It is emphasised that the investigation has been directed more towards a better understanding of the basic factors of discomfort glare, rather than to a simplified formulation of the data which could, of necessity, be only partly accurate.

TABLE 1.

Brightness of Source (candles/sq. in.)	Surround Brightness (foot lamberts) for:—				Probable room brightness (foot lamberts)	
	A Just Intolerable Glare	B Just Uncomfortable Glare	C Just Acceptable Glare	D Just not Perceptible Glare	Walls	Ceiling
0·5	0·2	0·9	4·2	18	1	2·5
1·0	0·6	2·3	11	43	2	5
2·0	1·7	6·0	31	120	4	10
5·0	5·8	21	120	430	10	25
10·0	15	56	340	1200	20	50

TABLE 2.

Brightness of Source (candles/sq. in.)	Ratio of Source Brightness/Surround Brightness for:—			
	A Just Intolerable Glare	B Just Uncomfortable Glare	D Just Acceptable Glare	D Just Not Perceptible Glare
0·5	1,130	251	54	13
1·0	755	197	41	10
2·0	532	151	29	7·5
5·0	389	108	19	5·2
10·0	302	81	13	3·8



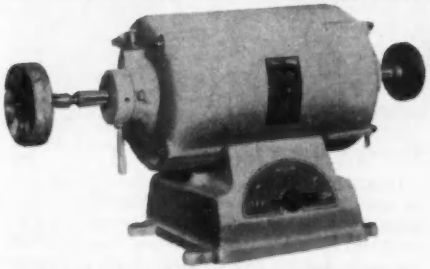
THE BUYER'S COLUMN

Household Appliance Award

WE learn from H.M.V. Household Appliances, Ltd., Hayes, Middlesex, that the complete range of domestic apparatus produced by the firm has now been awarded the guarantee seal of the Good Housekeeping Institute. A special label featuring the seal will in future be attached to each product.

Power for Dentures

DESIGNED specially for light dental duty, the "Cub" two-speed lathe shown in the illustration is a product of Brook Motors Ltd., Empress Works, Huddersfield. On load, speeds of 2,900 and 1,440 r.p.m. are selected by the rotary switch mounted in the base, and the machine is arranged for direct starting in the "high" speed position only. Two types of false nose attachments are available for a grinding wheel and a



"Cub" two-speed lathe, with buffing mop on one nose and grinding wheel on the other

buffing mop. Complete with these the lathe is priced at £12 10s. Further details are given in the company's list No. 267.

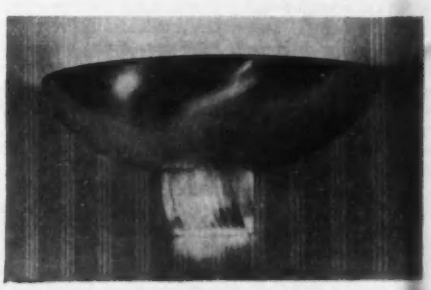
New Thyratrons

INTERESTING additions have recently been made to the range of vapour triode thyratrons for industrial uses marketed by Mullard Electronic Products, Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Two of these are the MT 17 and MT 57, which have current ratings of 0·5 and 2·5 amps respectively. With their small size and high standard of reliability, these new models are stated to be particularly suitable for use in motor speed control circuits.

Another new valve is the miniature gas-filled tetrode 2D21, which is primarily intended for use in relay or stabilised grid-controlled rectifier circuits where space is restricted.

Elegance in Illumination

ATTRACTIVE lighting effects are obtainable from the half-bowl wall bracket lamp shown in the illustration. A product of Merchant



Merchant Adventurers' wall bracket lamp

Adventurers Ltd., 43 Portland Road, London, W.11, this fitting is available in either anodised aluminium or a stove-enamelled colour spray. A cluster of polished plate glass fins, brightly illuminated, light the underside of the bowl.

Comfort for Work in Miniature

MANY operations in manufacture and research are best performed under observation through a magnifying glass. When ordinary spherical lenses are used, eye strain may result from the excessive demands on eye accommodation, due to the different distances of right and left eye images if binocular vision is required. To reduce the resultant fatigue, Engineering Developments (England), Ltd., 50 Pall Mall, London, S.W.1, have produced in conjunction with Imperial Chemical Industries, Ltd., an industrial magnifier (E.D.M. 105) incorporating a Perspex lens with one aspheric surface, which permits comparatively comfortable vision when placed six inches from the eyes and five from the object viewed, magnification in this case being nominally 2x.

The magnifier incorporates a 30 W fluorescent lamp and an opal Perspex reflector to provide 200 to 250 ft candles intensity of illumination at the working surface without excessive heat.

Adjustable Floodlight

DESIGNED for concentrated beam, diffusing beam or concentrated throw, according to the type of front used, the new floodlight projector (5125) developed by Metropolitan Vickers Electrical Co., Ltd., Trafford Park, Manchester 17,

uses a 1 kW lamp. It has a silicon-aluminium alloy body mounted on a cast stirrup of the same material, while the optical system consists of a polished anodised aluminium reflector and a heat-resisting front glass, the latter carried on a cast ring; the focus can be adjusted externally. Cable entry is provided through a packing gland to a cool wiring chamber.

Uses of Fusible Alloys

TIN containing fusible alloys which melt at temperatures low enough to be cast in wooden or paper moulds are described in a 24-page publication of the Tin Research Institute, Fraser Road, Greenford, Middlesex. The use of such alloys in assembly jigs and press tools are described and illustrated, and their applications in tube-forming are discussed. The use of the alloys in safety devices, moulds, and electro forming processes are other topics covered in this booklet, which is obtainable free from the address noted above.

Easy to Maintain Pre-heater

ATTENTION during development of the new G.E.C. 2 kW plastic pre-heater has been focused on reducing maintenance costs, which may be caused by frequent valve failures. The set uses only one oscillatory valve, an Osram ACT.9, and reduces the effect of mains fluctuations on valve life by incorporating a voltage stabilising transformer in the filament supply circuit. H.T. power is supplied from a 6-valve, full-wave rectifier. Controls are reduced to an on/off switch and push buttons, together with signal lights on the oven and a process timer. Several pounds of plastic pellets can be accommodated in the oven, which heats them at rates up to 1½ lb/minute.

Hearing Aid de Luxe

LUXURY in miniature for those hard of hearing is characterised by the one-piece hearing-aid shown in the photograph. Produced by Bonochord Ltd., 48 Wigmore Street, London W.1, and marketed as the "Micropac," this instrument incorporates a three-stage amplifier, a microphone, and h.t. and l.t. batteries, all housed in an engraved case of jeweller's gold measuring only 3½ in. by 2½ in. by ¾ in. A reversible receiver cord is provided, and the set has variable volume control and two stages of tone control. These give a frequency range of 250 to 5,000 c/s. Weighing only 5 oz, the set has its retail price fixed at £28 7s.

Gold-finished case for hearing aid

TRADE PUBLICATIONS

ELECTRIC MOTORS.—An illustrated leaflet issued by the Electrical Power Engineering Co. (Birmingham), Ltd., Bromford Lane, Birmingham 8, shows some machines from the company's a.c. and d.c. range.

CONSUMERS' UNITS.—All insulated consumers' service units designed to meet the general requirements of B.S. 1454: 1948 are fully specified in a booklet, list No. Z 170, sent us by Siemens Electric Lamps and Supplies, Ltd., 38 Upper Thames Street, London E.C.4.

TRANSPORT ACCESSORIES.—Recent developments in the field of activity covered by the Joseph Lucas group are reviewed in an attractively produced brochure obtainable from Joseph Lucas, Ltd., Great King Street, Birmingham 19.

EMERGENCY LIGHTING.—The principles of the Nife-Neverfayle system of emergency lighting are set out in a booklet recently issued by Nife-Batteries, Ltd., 50 Grosvenor Gardens, S.W.1, as publication No. 1949.

ELECTRIC LAMPS.—Prices of all the lamps manufactured by Siemens Electric Lamps and Supplies, Ltd., 38 Upper Thames Street, London E.C.4, are set out in List No. 994.

CASTORS.—Maintenance and production engineers should find information to interest them in the catalogue of "Flexello" castors and wheels, issued by Flexello Castors and Wheels, Ltd., Trading Estate, Slough, Bucks.

INDUSTRIAL PHOTOCELLS.—An interesting booklet with this title has recently become available from the Communications and Industrial Valve Department of Mullard Electronic Products, Ltd., Century House, Shaftesbury Avenue, London W.C.2. Principles of operation, spectral response characteristics and operating data are all dealt with, circuits are given, and there is a short bibliography.

ROUTE MAPS.—Newly come to our notice is a publication by High Duty Alloys, Ltd., Slough, Bucks, which might well be imitated by other firms. It contains maps of the districts surrounding the various works, information on travel and accommodation facilities.

TABLE COOKER.—The Stokes electric table cooker and accessories are featured in a four-colour leaflet sent us by Stokes Appliances, Ltd., 16 Dingwall Road, Croydon, Surrey.

MEASURING INSTRUMENTS.—Folders 1001 to 1003 of the Baldwin Instrument Co., Ltd., Brooklands Works, Dartford, Kent, deal respectively with instruments generally, with those for X-ray measurements and with photometry measurement.

THE WEEK IN NEWS

Electrical Firms Collaborate

AN interesting link between two firms in the electrical industry is announced this week. Two well-known engineering firms have jointly issued the following unamplified statement:

British Insulated Callender's Cables Ltd. and Ferranti Ltd. announce that an arrangement is now in force whereby their respective meter design and technical staffs are working in close collaboration.

Mr. P. V. Hunter, deputy chairman B.I.C.C., presents a cheque for £25 to Mr. C. O. Boyse to mark 25 years' service with the firm

Radar In War and Peace

THIS year's Faraday lecture deals with "Radar" and is being given by Dr. R. A. Smith at the Central Hall, Westminster, next Wednesday, January 18, at 6.30 p.m. Dr. Smith is superintendent of the research department of the Telecommunications Research Establishment, Ministry of Supply.

Radar presents a subject of absorbing interest, and Dr. Smith will explain in everyday language "how it works." In addition to describing wartime achievement of radar, reference will be made to its peace-time uses and to recent developments and expectations for the future. Lantern slides and demonstrations will supplement the lecture. Tickets of admission are not being issued.

Tax on Water Heaters Reduced

TREASURY proposals to reduce purchase tax on thermal storage water heaters and to exempt from tax instantaneous water heaters, first reported in our issue of November 17, have now been put into effect. The Order, made under Section 21 of the Finance Act, 1948, is entitled "The Purchase Tax (No. 6) Order, 1949" (S.I. No. 2453, 1949). It (a) reduces the tax on thermal storage water heaters suitable for operation from electric mains from 100% to 66⅔%, and (b) exempts from tax instantaneous water heaters which are not suitable for operation from electric or gas mains.

The reduction at (a) applies only to water heaters of the "self-contained" type, i.e. the factory-made assembly comprising an insulated vessel, heater and thermostat complete in an outer case. The exemptions at (b) applies only to instantaneous water heaters not operable from the mains, e.g. instantaneous heaters using "bottled" or Calor gas. The Order applies to specified appliances delivered, or on sale or appropriated to retail trade of similar purposes on or after January 9, and to imported goods entered with the Customs for clearance on payment of tax or delivered from bonded warehouse for home consumption on or after that date.

B.I.C.C. Veterans Rewarded

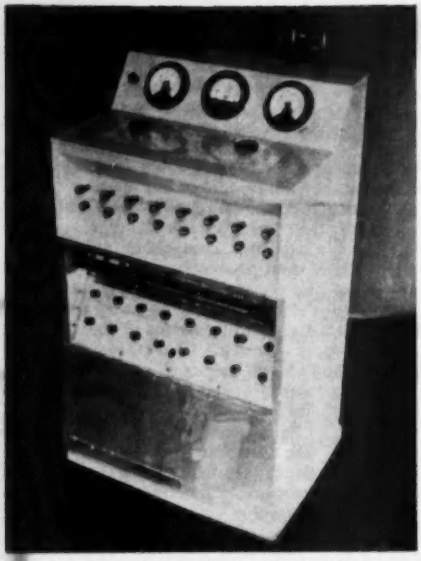
LONG service awards were recently presented to 78 members of the staff of British Insulated Callender's Cables Ltd. who completed 25 years' service with the company in 1949. In London, where 14 staff members qualified for awards, the presentations were made at Norfolk House by Mr. P. V. Hunter, C.B.E., deputy chairman. At the Belvedere works, Erith, 15 awards were presented by Mr. W. G. Hendrey, director, while the remaining 49 awards were presented at the Prescot Works by Ald. R. J. Hall, J.P., director.

New Cable Factory in the North

A NEW factory for W. T. Henley's Telegraph Works Co., Ltd. at Birtley, a few miles south of Newcastle-on-Tyne is almost completed. The

The First Half Century

In an action for damages: The plaintiff fell with the eggs underneath him and they therefore came to grief to the detriment of his clothes and the loss of the eggs. He was dragged two or three yards, and when the people came to his assistance and lifted him up they saw a stream which led them to believe that he had sustained a vital injury from which his life blood was fast ebbing away, instead of which it was but the yolk of that precious dozen of fresh eggs. The moral of the case is that people should not attempt to alight from electric tramcars unless they are sure of their footing.—*From our issue of January* 11, 1900.



An arc generator for spectral analysis will be among the French scientific exhibits in the Science Museum South Kensington, next month

factory will be principally engaged in the production of rubber-insulated electric wires and cables.

The site lies between the main Durham-Newcastle road and the London-Newcastle main railway line. Altogether it covers 45 acres, and the main factory building of nine single-storey bays has a floor area of nine acres. An administrative block stands centrally in front of the buildings facing the main road. In addition, there are various ancillary buildings including a canteen and dining hall, welfare department, boilerhouse, maintenance and repair shops.

Aerial view of W. T. Henley's new Birtley factory

London Exhibition of French Instruments

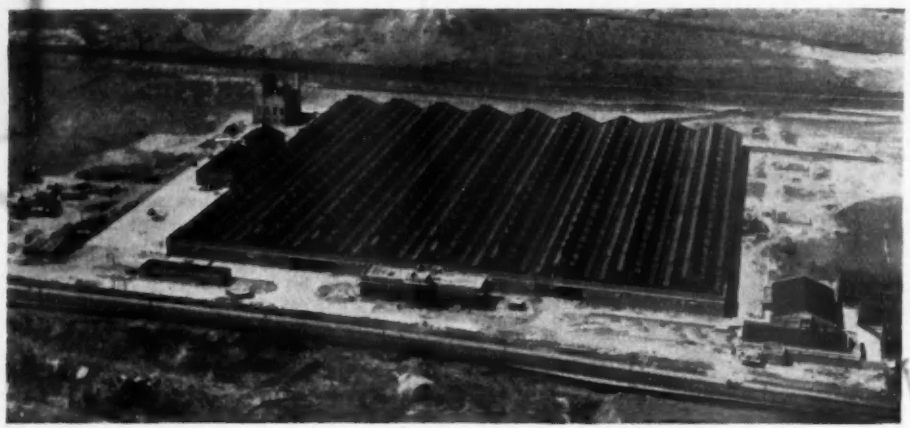
FRENCH and British scientific workers will be brought closer together by an exhibition of the latest French scientific instruments, to be held in the Science Museum, South Kensington next month. The exhibition will provide a comprehensive survey of French activity in scientific instrument technology as well as a review of progress in many fields of pure science. A collection of recent electrical apparatus will be included. Although many of the instruments may not be new or revolutionary to British science, it is certain that many items will differ in design and this, at least, will stimulate interesting discussion. Atomic physics will be represented by a section contributed by the Commissariat a l'Energie Atomique, and a number of French authorities will lecture on scientific subjects. The exhibition will be open from February 9 to February 26.

Robots in the B.B.C.

RADIO engineers have already been introduced to the unattended transmitter and the robot monitor in the chairman's address to the Radio Section of the I.E.E. given by Mr. Rowland Wynn, C.B.E., M.A., M.I.E.E. (ELECTRICAL TIMES, October 27, 1949). At Broadcasting House on Monday of this week, Mr. Wynn dealt with the subject non-technically from the standpoint of utilisation of man-power.

Hitherto, unattended transmitters have contained duplicate apparatus, resulting in considerably higher cost than the attended stations. Recent design tendencies have been towards the use of transmitters consisting of a number of small units in parallel, so designed that the failure of a single unit only reduces the transmitter power by a proportionate amount, thus giving the benefits of unattended operation at lower cost.

The robot monitor, designed to free an average of 3·2 men per monitoring station, operates by a critical comparison of the received signal against a reference signal, and will sound an alarm for deviations in quality quite undetectable by the human ear.



New Plant for N.W. Division

THE second stator of two 50,000 kW, 33,000 V, 3,000 r.p.m. Metrovick turbo-generators has just arrived at the site of the new Agecroft power station. The only generating station in the N.W. division scheduled for completion this year, Agecroft will contain two Metrovick 52,500 kW turbo-sets each consisting of a 50,000 kW main generator and a 2,500 kW house service generator.

Stator of a Metrovick turbo-generator being delivered at Agecroft

Eastern Board's Ban on Fires Criticised

EASTERN BOARD'S decision last week to ban sale of electric fires in all their 138 showrooms was criticised at their consultative council's meeting on Friday. Opening the discussion, Mr. A. W. Sanders said he could not understand why the Eastern area particularly had to suffer. The Board's action had been bureaucratic and arbitrary. If action had to be taken, why was it not taken at national level?

Other speakers said that manufacturers should be asked to restrict sales of fires and pointed out that people in the Eastern area could still obtain them from private traders. Alderman W. J. Bennett, chairman, said that the real problem was not a consumer problem at all. Engineers should design their technical work with more regard for consumers.

Works War Memorial Unveiled

A BRONZE memorial plaque bearing the names of 73 members of B.I. Callender's Cables Prescot works staff who lost their lives in the last war was recently unveiled at Prescot. A large and representative gathering witnessed a simple ceremony when the oldest works employee, Mr. C. Burke, with 53 years' continuous service, handed over the safe keeping of the plaque to Alderman R. J. Hall, J.P., a director.

German Engineers Offered Jobs

GERMANS experienced in electrical instrument design or light electro-magnetic devices are being offered jobs by the English Electric Co., Ltd. Advertisements to this effect are appearing in German newspapers. According to a British newspaper report on Tuesday, an official of the company explained that "certain engineers are sometimes hard to find here."

Radio Servicing Examination

CLOSING date for the May, 1950 Radio Servicing Certificate Examination is February 1. The written examination will be held on May 2 and 4 at centres throughout the British Isles. The practical examination will be held on May 20 at London, Birmingham, Manchester, Glasgow and Bristol.

Building Restrictions

UNDER a new Ministry of Works Order which comes into force on February 1 next, changes have been made in the categories of "designated buildings" and in the licence limit for building or civil engineering work to such buildings. Warehouses, storage buildings, office buildings and schools become subject to the limit of £100 which may be expended on such work during the period July 1, 1949, to June 30, 1950. This will not affect work carried out on these buildings under the £1,000 limit up to January 31, 1950, but a licence will be required for work done between February 1 and June 30, 1950, if the total cost exceeds £100. For industrial buildings the licensing limit has

Vicar of Prescot, Canon O. C. Martin assisted by Rev. B. Frost (Prescot Congregational) and Rev. A. J. Trebilco (Prescot Methodist) dedicates the B.I.C.C. memorial at Prescot

been reduced from £1,000 to £500, but there is no change in the £100 limit permitted for unlicensed work on any single property.

Change in Year Proposed

ON January 31, at 2.30 p.m., meetings of the Electrical Contractors' Association, N.E.C.T.A., and the National Federated Electrical Association are to be held to consider proposals to alter the financial year of all three organisations to extend from March 1 to February 28, instead of from May 1 to April 30 as at present. If the proposal is approved, the Associations' current financial year will be of ten months' duration only. Membership subscriptions will be reduced accordingly. Resolutions are also to be submitted, to provide that the provisions of the 1948 Companies Act regarding members of the Council who have reached the age of 70 shall not apply to the E.C.A. and N.E.C.T.A.

"More Current Events"

THOSE who saw Norman Axford's revue "Current Events" produced by the Northmet Players in 1947, would have little difficulty in recognising the same delicate touches in "More Current Events," which ran for four nights last week at the Church Hall, Southgate, even though the company is now known as the "EDEEB Players."

Produced by Roger Maddock, the show certainly lived up to its name, the sketches commenting on life in the electrical industry with wit and point, and being interspersed with musical and dance numbers. The standard throughout was such that it would be invidious to single out any particular turn for special commendation, except to say that the chorus—so often the weak spot in an amateur production—could have given points to many a West End show, their performance in the particularly difficult toyshop number reflecting great credit on June Snelling, who trained them.

Shop Assistants' Wages and Holidays

TWO Orders (S.I. Nos. 2276/7), made by the Minister of Labour regarding shop assistants, come into operation on January 23. These apply to *inter alia* concerns in the retail sale of electrical, heating, lighting and cooking appliances, radio and television apparatus, ironmongery and household goods, and set out the annual holidays to be allowed, and the statutory minimum wage payable to workers, other than watchmen, in those trades.

Briticent Presentations

WRIST watches and other inscribed gifts were presented to four employees of the British Central Electrical Co. Ltd., at the firm's Christmas dinner. In making the awards, Mr. G. Conradi, general manager and director, commented that together, Messrs. F. St. C. Wyand, R. Smith, A. Shepperd and Miss B. Savage had completed 77 years' service.

NEWS IN BRIEF

After consultation with the Central Price Regulations committee the Board of Trade have made a Hire-Purchase and Credit Sale Agreements (Maximum Prices and Charges) Order, 1950. The Order supersedes all earlier Orders controlling hire purchase and credit charges on most price-controlled goods as from January 23.

First stage in the conversion of South London's trams begins next October.

The Minister of Fuel and Power on Friday published in the *London Gazette* a further list of approved electricity meters as required by the Electricity Act, 1947, and Electricity (Supply) Acts, 1882 to 1936.

Notice No. 78, issued by the Commissioners of Customs and Excise, consolidates the groups of goods chargeable with and exempted from purchase tax.

Mr. C. H. Gray, general secretary of the World Power Conference, has drawn our attention to the fact that Mr. E. W. Golding is joint author with Mr. Haldane of the paper on "Wind-power" to be read at the Conference in July next. Also, France is providing a paper on nuclear energy, as we listed on page 831 of our Dec. 15 issue.

We are asked to point out that Smith and Ansell Ltd., one of the firms concerned in the manufacture of light fittings in the new House of Commons as reported in our December 29 issue, are a totally owned subsidiary of Falk Stadelmann and Co. Ltd. The firm responsible for the new annunciator system is Exchange Telegraph Co. Ltd., and not Standard Telephones and Cables Ltd.

Spaced at intervals of 40 yards, twenty-six Revo "Blendlite" lanterns now illuminate The Rock at Bury, Lancs

ELECTRIC SUPPLY NEWS

Belfast

During the year ended March 31 last, the Corporation Electricity Department sold just over 285 million units, an increase of nearly 33 millions over the 1947-48 figure. There was a net surplus for the year of £154,648. New consumers connected to the network numbered 7,549. In his annual report, Mr. W. J. McC. Girvan, city electrical engineer and general manager, states that although the financial result may be considered satisfactory, the margin of generating and distribution resources provided for emergency conditions had been drawn upon for normal purposes. This circumstance increased both the profits and the anxiety of the engineering staff. He records that never before has there been such a large demand on the Department for the hiring of cookers, kettles and wash boilers. Although it was difficult to obtain the large variety of consumers' equipment required for replacement, the rate of changing supplies from d.c. to a.c. increased appreciably; and 1,274 supplies were changed over by agreement.

Bradford

The City Council has decided to borrow nearly £300,000 to provide new fireplaces and gas or electric cookers in more than 6,000 houses.

Gt. Yarmouth

Following representations from the Town Council, members are to meet officials of the B.E.A. to discuss details of the proposed new generating station.

Londonderry

At the recent meeting of the Corporation, the proposal to pay approximately £400 as compensation to employees who remained on duty during the recent power strike in N. Ireland was approved.

Meaford

The Midlands Division of the B.E.A. has made application to the local authorities for approval of plans for the erection of the first half of the Meaford "B" generating station which is to have a plant capacity of 120 MW.

Nottingham

A further 53 MW turbo-alternator has been put into commission at the North Wilford power station, raising the installed capacity of the station to 203,500 kW. A further 52·5 MW set is also on order.

Scunthorpe

The Council has now received from the Yorkshire Electricity Board a revised account for £1,275 for street lighting—£77 more than the account which was returned (ELECTRICAL TIMES, December 8). The chairman of the Public Lighting Committee has said that the Board had accepted the council's objection to the proposed charge for maintenance of the remote control system. It had offered to substitute charges assessed on the basis of time and materials plus 20% establishment charge. Council officials were negotiating for a reduction of this charge.

Willton

Having received consent to loans for installing electric wash boilers in certain council houses, the R.D.C. has decided to seek loan sanction to similarly equip all their post-war houses.

LIGHTING SCHEMES

Bridgwater.—The T.C. has submitted to the M.o.T. for approval a scheme for the provision of sodium lighting in the town's main streets.

Bridlington.—The T.C. has accepted an offer by the Yorkshire Electricity Board to instal different types of lighting to allow the Highways Committee to select the most suitable system.

Hornsey.—The Council is to improve street lighting in Archway Road and Aylmer Road, at an estimated cost of £4,720.

Kingston-upon-Thames.—The T.C. has accepted a tender of £2,432 for improving the lighting of a portion of the town centre.

Mansfield.—Schemes for relighting several main thoroughfares have been approved by the Town Council. Experimental electric lighting is to be installed in Chesterfield Road.

Margate.—The town's Hotel and Boarding Association is pressing for the adoption of £45,000 illuminations scheme.

Nelson.—The borough surveyor has reported that the task of extending the new electric lighting system—at present confined to main roads—to bus routes would cost £11,500 with an additional £4,500 for removing existing lamps.

Nottingham.—New sodium lighting, utilising 33 double-armed columns, is being installed in University Boulevard.

Peel, I.O.M.—The Commissioners have agreed to the installation of fluorescent street lighting in certain parts of the town.

Skegness.—The public lighting superintendent is to prepare a scheme for lighting the parades by electricity to provide class "A" lighting.

Stockport.—The Corporation is seeking a loan of £84,000 to convert 4,000 gas-lighted street lamps to electricity.

Trowbridge.—The M.o.T. has rejected the U.D.C.'s application for the installation of fluorescent lighting in the centre of the town, but has stated a cheaper scheme would be considered. The Council has approved the recommendation of the Highways Committee that as the cost would be only £600 more than the cheaper form of lighting further representation should be made to the Ministry.

COMPANY ACTIVITIES

Andhra Valley Power Supply Co.

Power supply revenue for the year ended June 30: Rs.63,44,472 (*Rs.62,69,474*), increased with sundry revenue to Rs.67,33,007 (*Rs.66,11,660*). After usual charges, including tax Rs.18,05,000 (*Rs.17,90,000*) and depreciation Rs.4,00,000 (*same*) net profit Rs.21,93,406 (*Rs.22,49,773*). Brought in Rs.2,62,403 (*Rs.68,454*), tax recovered Rs.1,07,931 (*same*), available after December, 1948, half-yearly Preference dividend and Ordinary tax free dividend Rs.30 (*same*). Rs.17,52,740 (*Rs.16,15,158*). To staff bonus Rs.76,333 (*Rs. 93,721*), special repairs Rs.36,015 (*Rs.8,899*), general reserve Rs.3,02,605 (*Rs.1,00,000*), dividend reserve Rs.13,00,000 (*nil*), leaving balance Rs.37,787. Final Ordinary dividend recommended from dividend reserve of Rs.45 tax free (*same*).

International Combustion (Holdings) Ltd.

It has been announced that over 900,000 Ordinary 5% stock units have been placed with financial and investment companies. It is stated that a proportion will be made available to the public through the Stock Exchange.

Madras Electric Supply Corporation

At this meeting, Mr. K. A. Scott-Moncrieff, chairman, said, having taken advice, steps were being taken to ask the stockholders to approve a reduction of capital by the repayment of the Preference stock. He also referred to the receipt of a communication from the Madras Government, intimating that it was considered that the valuation of the undertaking (ELECTRICAL TIMES, Dec. 1) is considered excessive.

Mann, Egerton & Co.

For the year to September 30, consolidated trading profit was £154,334 (*£182,442*), after allowing for depreciation £15,166 (*£13,959*), audit fee £865 (*£905*), supplementary pensions £2,500 (*same*), employees' bonus £4,000 (*same*), directors' emoluments £20,654 (*£20,151*) and directors' allowance, etc., £1,250 (*same*). With interest £45, there is £154,379 (*£192,518*) available. To tax £86,500, assets replacement reserve £10,000, stock depreciation £10,000 (*£20,000*), general reserve £20,000 (*same*), Preference dividend £9,258 (*same*), Ordinary dividend 50% £9,772 (*same*), bonus 30% £5,864 (*same*). Carried forward, £38,214 (*£35,229*).

Radio Rentals Ltd.

The group trading profit for the year to August 31 was £459,987 (*£323,382*), and net profit £150,162 (*£115,454*). Deducted is radio sets depreciation, £240,892 (*£165,538*), depreciation and amortisation £8,587 (*£5,537*), written off subsidiary investments £943 (*nil*), directors' emoluments £22,430 (*£16,066*), audit fee £1,752 (*£1,733*), and tax £35,715 (*£21,354*), Preference dividends absorb £3,026, and with £89,847 (*£98,276*) brought in, there is £236,983 (*£212,005*) available. To share issue expenses £3,300 (*£1,058*), subsidiary formation expenses £1,064 (*nil*), preliminary expenses written off £190 (*nil*), tax equalisation £67,300 (*£55,019*), reserve for set replacement £25,000 (*£21,000*), Preference dividend £4,537 (*£3,938*), Ordinary interim 10% £7,199 (*£4,884*), and final 15% £10,799 (*£11,395*), leaving £117,594 carried forward.

Tata Hydro Electric Power Supply Co.

For year to June 30, power revenue was Rs.43,49,325 (*Rs.43,23,648*), increased with sundry revenue to Rs.50,74,002 (*Rs.50,00,959*). After deduction of usual charges including tax Rs. 14,20,000 (*Rs.14,32,000*) and depreciation Rs.2,00,000 (*same*), net profit is Rs.19,43,527 (*Rs.20,43,155*). Brought in Rs.1,95,827 (*Rs.1,01,795*) and tax recovered Rs.1,95,300 (*same*), available after December, 1948, half-yearly Preference dividend and Rs.3 (*same*), tax free on Ordinary Rs.14,82,174 (*Rs.14.87,770*). To staff bonus Rs.92,138 (*Rs.1,05,962*), special repairs Rs.55,335 (*Rs.40,684*), general reserve Rs.1,04,859 (*nil*), dividend reserve Rs.12,00,000 (*nil*), forward Rs.29,842. Final Ordinary dividend recommended from dividend reserve of Rs.4 annas 8 (*same*) per share tax free.

Tata Power Co. Ltd.

Power revenue for the year ended June 30 was Rs.1,15,22,237 (*Rs.1,12,47,798*), increased with sundry revenue to Rs.1,17,22,338 (*Rs.1,14,38,397*). After deduction of usual charges, including tax Rs.34,63,000 (*Rs.34,15,000*), and depreciation Rs.9,00,000 (*same*), net profit is Rs.41,90,250 (*Rs.42,56,366*). Brought in is Rs.3,80,646 (*Rs. 1,52,641*), recovered tax Rs.2,03,836 (*same*), available after half-yearly Preference dividend and Rs.25 per share, tax free Ordinary dividend (*same*). Rs.35,35,194 (*Rs.33,73,305*). To staff bonus Rs.1,06,602 (*Rs.1,10,520*), special repairs Rs.15,655 (*Rs.1,43,952*), general reserve Rs. 10,94,689 (*Rs.5,00,000*), dividend reserve Rs. 23,00,000 (*nil*), leaving a balance of Rs.18,248. Directors recommend dividend for half-year to June 30 of Rs.45 per share, free of tax (Rs.50), from dividend reserve.

Dividends Declared

Worthington Simpson Ltd.—Owing to delay in completing accounts, the board has decided to pay interim dividend of 10%, payable on January 31.

Hackbridge Cable Holdings.—Interim dividend of 7½%.

Greenwood and Batley.—Interim dividend of 5% (*same*).

W. Canning and Co.—The final Ordinary dividend for 1949, and Preference for the five months ending May 31, 1950, will be paid during May. The Ordinary interim and the six months' Preference dividends to November 30 will be paid during November.

Commercial Information

CONTRACTS OPEN

*The date stated is the last day for receiving tenders. Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, London S.W.1, quoting reference number.*

January 14.—Dublin T.C.—Supply of one electric centrifuge 200/250 V a.c., maximum r.p.m. 4,000, with angle head capable of taking eight 50 mil. centrifuge tubes. City Manager and Town Clerk, Finance Section, City Hall, Dublin.

January 14.—Halifax T.C.—Installation of vehicle-actuated traffic control signals at Cow Street-Gibbet Street junction. G. Holden, borough engineer, Crossley Street, Halifax. Deposit £2 2s.

January 16.—Romford T.C.—Provision and erection of 80 street lighting units on (a) Gobions estate, part 1; (b) Heaton Avenue; (c) Highfield Road; (d) Hill Rise Road. Borough engineer and surveyor, Town Hall, Romford. Deposit £2 2s.

January 16.—Southport T.C.—Installation of floodlighting in (a) seaward side of Rotten Row; (b) South Marine Gardens. Installation of "fairy" lighting on trees on west side of Lord Street. Corporation's lighting engineer, 21 Eastbank Street, Southport.

January 16.—Uruguay.—Supply of automatic telephone exchange (step-by-step) capacity 700 lines; equipped 400 lines and 500 telephones. Usinas Electricas y Telefonos del Estado, Montevideo. B.o.T. (Ref. CRE (IB) 36780/49)*

January 18.—Wandsworth T.C.—Electrical works to commence April 1. R. H. Jerman, Town Clerk, Municipal Buildings, Wandsworth, S.W.18.

January 21.—Bootle T.C.—Six months' or twelve months' supply of electric cables, flexes and lamps from April 1. Borough engineer and surveyor, Town Hall.

January 21.—Newcastle-on-Tyne T.C.—Six diesel fuel pumps, electrically operated, pre-set, 3-phase or single phase, a.c. 400-440 V. Frank S. Taylor, general manager, Manors, Newcastle-on-Tyne 1.

January 21.—Peterborough T.C.—Electric lighting and power installations to 76 houses on Dogsthorpe-Newark estate. F. J. Smith, city engineer and surveyor, Town Hall, Peterborough. Deposit £2 2s. Advertised in this issue.

January 23.—Uruguay.—300 metres of 220 V armoured cable, 3 × 16 mm 2. Administracion Nacional de Combustibles, Alcohol y Portland. B.o.T. (Ref. CRE (IB) 37760/49).*

January 23.—Bedfordshire C.C.—Installation of electric light at North Bedfordshire College of Further Education, at Cauldwell Street, Bedford; for education committee. County architect, Shire Hall, Bedford. Deposit £2 2s. Advertised in this issue.

January 24.—New Zealand.—750 miles of tinned (or alternatively untinned) copper wire, New Zealand Post and Telegraph Department, Wellington. B.o.T. (CRE (IB) 38568/49).*

January 25.—Hertfordshire C.C.—Supply of electric lamps for one year, from April 1. Purchasing officer, The Old Rectory, Hatfield, Herts.

January 25.—Northampton R.D.C.—Electrical installation to 64 houses now in course of erection. R. J. Miller, architect, 1 Cheyne Walk, Northampton.

January 25.—Yeovil T.C.—Supply and erection of 35 25 ft and 23 15 ft steel electric light columns including lanterns, lamps, control gear and wiring. Town Clerk, Municipal Offices, Yeovil. Advertised in this issue.

January 26.—Uruguay.—Three electro-generating sets, each comprising a diesel motor and direct coupled generator of 600 kW, generating 6,300 V, a.c., 3-phase, 50 c/s. Usinas Electricas y Telefonos del Estado, Montevideo.

January 28.—South Africa.—Supply, delivery and erection of poles, line material, wire and cables, transformers and service connections. Village Management Board, Bonnievale, Cape Province. Deposit £2 2s.

January 30.—Gosport T.C.—Electrical goods for year ending March 31, 1951. Borough engineer, Town Hall, Gosport.

January 30.—Uruguay.—50,000 kgs of insulating paste for packing in underground armoured cable connection boxes. Usinas Electricas y Telefonos del Estado, Montevideo.

January 31.—New Zealand.—20 miles of triple flame-proof wire. New Zealand Post and Telegraph Department, Wellington. B.o.T. (CRE (IB) 38591/49).*

January 31.—New Zealand.—20,000 yards of power cable. New Zealand Post and Telegraph Department. B.o.T. (CRE (IB) 38567/49).*

January 31.—New Zealand.—Supply and delivery of hydraulic and electrical components for lifting gear for surge chamber gate at Lake Tekapo H.E. development scheme. Gear includes: 2 oil-hydraulic pumps, 25 gpm. at 200 lb/sq in. pressure; 27 oil-hydraulic valves, ¼ to 3 in. sizes, hand and solenoid operated etc.; 2 oil pressure gauges; 2 vacuum gauges; 250 ft hydraulic pipes, ¼ in. to 3 in. sizes; 2 electric motors, 5 h.p., squirrel cage type. Stores Manager, Ministry of Works, Government Buildings, Wellington. B.o.T. (Ref. CRE (IB) 36267/49.)*

February 2.—Enfield.—Supply of electric lamps for Enfield Group Hospital management committee from April 10. Supplies officer, Chase Farm Hospital, Enfield.

February 2.—Australia.—(a) Control board for 33 kV switchgear and turbo-alternators, (b) control board for 3·3 kV and 415 V station auxiliary switchgear, (c) lighting of the control room. Manager, City Electric Light Co., Ltd., Boundary Road, Brisbane.

Due to limitation of space, Overseas Contracts are only published twice in the above section. A complete list is available for reference at our offices

February 2.—Uruguay.—300 porcelain inlets for cables. Specification No. 3217. Usinas Electricas y Telefonos del Estado. B.o.T. (Ref. CRE (IB) 37583/49).*

February 3.—Belfast T.C.—Electrical apparatus and various accessories. Electricity Department, East Bridge Street, Belfast. Advertised in this issue.

February 3.—Uruguay.—531,000 porcelain insulators (various types). Specification No. 3219, Usinas Electricas y Telefonos del Estado. B.o.T. (Ref. CRE (IB) 37583/49).*

February 3.—Tottenham T.C.—Supply of electric lamps. M. Lindsay Taylor, town clerk, Town Hall, Tottenham, N.15.

February 4.—Swansea T.C.—Electric lamps for public lighting for twelve months from April 1. Borough Engineer and Surveyor, Guildhall, Swansea.

No date stated.—Egypt.—Sluice gates, pipelines and surge tanks for H.E. power station. Aswan Dam. Kennedy and Donkin, 12 Caxton Street, S.W.1. Deposit £20.

No date stated.—Aberdeen C.C.—Electrical installation at Bucksburn, Dyce, Hatton of Fintray, Parkhill and Skere schools. George Watt and Stewart, architects, 214 Union Street, Aberdeen.

No date stated.—Peeblesshire C.C.—Electrical installation for treatment centre at Peebles High school. Reid and Forbes, architects, 17 Great Stuart Street, Edinburgh.

PRICES OF CABLE MATERIALS
(at Tuesday night)

COPPER, electrolytic	£153	0	0
LEAD, good soft pig (foreign) ...	97	0	0
,, "English" quality ...	98	10	0
TIN (99·99·75%) ... (Cash) ...	£600—£600½		
,, (3 months)	£581—£581½		
ALUMINIUM, commercial purity (del.)	112	0	0
ARMOURING:			
Galv. Steel Wire (0.104 in.)	39	10	0
Mild Steel Tape (0.04 in.)	26	0	0
Note. Figures quoted are M.o.S. spot prices. For future prices the following premiums must be daded:—			
For Copper delivered in 2nd or 3rd month after order (per ton) ...	2	10	0
For Copper delivered in 4th, 5th and 6th month after order (per ton) ...	5	0	0
For Lead delivered in 2nd or 3rd month after order (per ton) ...	2	0	0

CONTRACTS CLOSED

Blackburn.—Provision of two electric lifts at Queens Park Hospital for Manchester Regional Hospital Board. EVANS LIFTS, LTD., £2,210 (recommended).

Coventry T.C.—Electrical installations for 122 houses. THREE SPIRES ELECTRIC CO., £5,087 (recommended).

Dagenham T.C.—Electrical installations for dwellings on Heath Part estate. EVANS AND SHEA LTD., £10,705. Provision of lifts on Heath Park estate. J. & E. HALL LTD., £8,114.

Kingston-on-Thames T.C.—Supply and erection of street lighting equipment in London Road, Richmond Road, Eden Street, High Street. The ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., £2,424.

Lancaster.—Supply and erection of generating plant at Lancaster Moor Hospital for Manchester Regional Hospital Board. PETER BROTHERHOOD LTD., £6,884 (recommended).

Luton T.C.—Electrical installations at County primary infants school, Ashcroft Road. MAY AND ROBERTSON LTD., £2,760.

Middlesex C.C.—Supply of fluorescent tubes and electric lamps. THORN ELECTRICAL INDUSTRIES, LTD., £3,368.

New Zealand State H.E. Dept.—Two 20,000 kVA banks of transformers, 66/11 kV, complete with "on-load" tap-change gear, for Papanui substation. BRUSH ELECTRICAL ENGINEERING CO. LTD.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Electro Developments (Leicester) Ltd.—Meetings of creditors and members at offices of Messrs. A. C. Palmer and Co., Court Chambers, Friar Lane, Leicester, on February 8 at 11 a.m. and 11.30 a.m. respectively.

Llandiloes Electric Light Co. Ltd.—Resolution for voluntary winding up passed at meeting on December 20. Miss Lily S. Deacon, 87 Tettenhall Road, Wolverhampton, appointed liquidator.

BUSINESS NOTICES

Change of Address.—The Manchester office of the SIMPLEX ELECTRIC CO., LTD., is now at 1 Union Street. Tel.: Deansgate 6511-2.

New Branch.—STANDARD TELEPHONES AND CABLES, LTD. (Newport Cables Division) announce the opening on January 23 of a new branch office and depot at 7-9 Tempest Hey, Liverpool 2. Tel.: Central 0756. This branch will be under the management of Mr. A. D. Fairless.

New Phone No.—The telephone number of VACTRIC, LTD., Newhouse, Motherwell. is now Newhouse 680-689.

Acquisition.—Arrangements have now been completed under which the control of the HOPKINSON ELECTRIC CO., LTD., has been taken over by the BRUSH ELECTRICAL ENGINEERING CO., LTD. We understand that it is proposed to continue the same line of manufacture at the factory as hitherto, although much of this work done elsewhere in the organisation will be transferred to Cardiff.

Engine Manufacture.—RICHARDSON WESTGARTH AND CO., LTD. and SULZER BROS. (LONDON), LTD. have concluded an agreement under which the former firm will manufacture Sulzer engines for land installations at the Sunderland Works of the associated company, GEORGE CLARK (1938), LTD.

Lamp and Lighting Agreement.—E. K. COLE, LTD. and EKCO-ENSIGN ELECTRIC, LTD. announce the conclusion of an agreement with THORN ELECTRICAL INDUSTRIES, LTD., to provide for close technical and manufacturing cooperation in the electric lamp and lighting fields. It will, they state, entail the use of large-scale manufacturing techniques new to this country and will enable the companies to reduce costs and compete more favourably, particularly in export markets. The advantage of the co-operation between Thorn's and Sylvania Electric Products Inc. of U.S.A., will be available to Ekco-Ensign.

PROSPECTIVE BUSINESS

Berkshire C.C.—Erection of hutted classrooms at Newbury county girls school. County architect, Wilton House, Parkside Road, Reading.

Berwick T.C.—Erection of six houses and shops on Prior Park housing estate. Borough surveyor, Municipal Buildings, Berwick.

Berwick-on-Tweed T.C.—Erection of 3 pairs of house-shops. Borough surveyor, Municipal Buildings, Berwick-on-Tweed.

Bolton T.C.—Erection of 29 two- and three-bedroomed houses and one-bedroomed flats on Leonard Street estate. Housing Director, Town Hall, Bolton.

Camberwell T.C.—Erection of 50 dwellings on site No. 31, Melford Road. John Grey and Partner, 56 Oakley Street, S.W.1.

Chipping Norton R.D.C.—Erection of 10 houses at Steeple Barton. H. Cooper and Sons, 51 Cornmarket Street, Oxford.

Cork C.C.—Erection of 10 houses at Chapel Street, Dunmanway. Council's offices, County Home, Clonakilty.

Crayford U.D.C.—Erection of 28 three-bedroom houses, four two-bedroom houses and 15 one-bedroom bungalows at Slade Green, part 1. Engineer and surveyor, Town Hall, Crayford, Kent.

Durham County E.C.—Contemplate adapting Walworth Castle near Darlington as school for subnormal children. County architect, G. R. Clayton, Court Lane, Durham.

Glendale R.D.C.—Erection of 40 houses at Wooler. Architects, Reavell and Cahill, Lloyds Bank Chambers, Alnwick.

Hampshire C.C.—Erection of secondary school at Romsey Road, Winchester. County architect, The Castle, Winchester.

Helmsley R.D.C.—Erection of 24 houses in three groups. Architects, Needham and Thorp, 6 High Petergate, York.

Ipswich T.C.—Erection of 76 houses on Castle Hill estate. Borough engineer and surveyor, 19 Tower Street, Ipswich.

Isle of Wight R.D.C.—Erection of 16 houses at Freshwater. Architects, E. L. Smith and Son, Melville Chambers, Sandown.

Jarrow-on-Tyne T.C.—Building 84 flats in Albion Street. H. W. T. Perkins, borough engineer, Town Hall, Grange Road, Jarrow.

Manchester T.C.—Conversion of an aged people's home, "Hazelcroft," Alderley Edge, near Manchester.

Offaly C.C.—Erection of 94 labourers' cottages in Offaly County Health district. County secretary, Courthouse, Tullamore.

Southgate T.C.—Erection of block of 18 flats on Barrowell Green Estate. Borough engineer and surveyor, Town Hall, Palmers Green, N.13.

Southwell R.D.C.—Erection of 20 houses at Southwell Road, Eakring. Surveyor, S. Cooper, 8 Westgate, Southwell.

Sunderland T.C.—Additional sleeping accommodation to be built at Fulwell Fire Station. Borough architect, H. C. Bishop.

Teignmouth U.D.C.—Erection of 44 houses. Engineer and surveyor, Bitton Park, Teignmouth.

Tynemouth T.C.—Approved plans for erection of eight firemen's houses on Lynn Road estate and four in Langley Road on West Chirton estate. Erection of a branch library and flats in Marina Avenue, North Shields. Borough engineer, 19 Howard Street, North Shields.

Windermere U.D.C.—Erection of 20 semi-detached houses on Oldfield estate. Council's architects, Messrs. Walker, Carter and Walker, Crescent Road, Windermere.

Workington.—Extensions costing £170,000 are to be made to Workington Infirmary. Newcastle-on-Tyne Regional Hospital Board (Cumberland and Westmorland Area), 1 Lonsdale Street, Carlisle.

OVERSEAS OPPORTUNITIES

Brazil.—Sociedade Anonima Magalhaes Comercio e Industria of Rua do Apolo 53/59, Caixa Postal 19, Recife, Pernambuco, wish to represent on an exclusive basis U.K. manufacturers of motor-generator sets, from 1 to 100 kW, and diesel engines, from 10 to 200 h.p.

Canada.—Messrs. Consolidated Industries Ltd., of 229 Main Street, Winnipeg, Manitoba, are anxious to contact U.K. manufacturers of toasters, electric kettles, heating pads, vacuum cleaners, electric irons and food mixers.

U.S.A.—The Spero Electric Corporation, 18222 Lanken Avenue, Cleveland 19, Ohio, wish to import micrometers, testing machines, transformers, rectifiers, irons, kettles, toasters, etc., electrical wires and insulated cables and electrical bell equipment, indicating and recording instruments from the U.K.

YOUR QUERIES ANSWERED

"Rabaldo" shavers, makers of? P.E.S.—John A. Fransen Ltd., County Hall, Northwood Hills, Middx. (17479)

Electric mouse trap, makers of? E.E.B.—Robert Joliffe Trust, Aston Clinton, Bucks. (17483)

"Grelco" adaptors, makers of? E.E.B.—Grelco Ltd., Grelco Works, Hopcott, Minehead, Somerset. (17503)

B.E.L. violet ray equipment, makers of? P.J.M.—This equipment was made by the Bower Electric Ltd., but the concern went out of business many years ago. (17498)

E.F.E. accessories, makers of? T.—E. F. Electro Ltd., Willow Lane, Watford, Herts. (17509)

"Renat" lighting fittings, makers of? T.E.—New Endeavour Engineering Ltd., 4 Avenue Road, Harlesden, London N.W.10. (17513)

The above are selected from the questions we have answered this week. If you have a query, send it to us.

ANSWERS WANTED

14-volt Christmas tree lamps (nobbly type), makers of? T. (17517)

Deri Engineering Co, address of? J.P. This firm makes the "Puro" fire. (17521)

COMPANY REGISTRATIONS

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Airmetal Ltd., Allen House, Newarke St., Leicester. Heating, ventilating, lighting, mechanical, electrical and general engineers, etc. Cap.: £2,000. Subs.: A. N. Holmes, J. W. Hamilton.

Fred Stones and Son Ltd., 2 St. Andrews Road South, St. Annes-on-Sea, Lytham St. Annes. Electricians, etc. Cap.: £1,000. Dirs.: F. Stones and W. Stones.

Frankel and Viebarn Ltd., 33 Blackfriars Street, Manchester 3. Power station and boiler house engineers. Cap.: £500. Dir.: W. Kulka.

Lincoln Batteries Ltd., Lincoln Works, Arterial Road, Southend-on-Sea. Cap.: £3,500. Dirs.: G. H. Negus, R. H. Negus, D. G. Negus.

Leonard Wadsworth and Co. Ltd. Electricians, etc. Cap.: £1,000. Subs.: W. B. Roomes and A. K. Lee.

TRADE MARK APPLICATIONS

This information is extracted from the Official Journal by permission of the Controller.

Darn-a-Lite. 677,169. Class 11. Electric torches. Radio Electric Development (Crewe), Ltd., Excelsior Works, Walthall Street, Crewe.

Hexa. 656,834. Class 9. Neon advertising signs, electric transformers and battery chargers. F. C. Hill and Co., Ltd., 17 Bilston Street, Wolverhampton.

Mullard. B669,339. Class 11. Heating apparatus and parts thereof and fittings therefor, cooking, refrigerating, drying, ventilating, air-conditioning, lighting installations, electric lamps for use in photography, electric torches and filters. Mullard Electronic Products, Ltd., Century House, Shaftesbury Avenue, London W.C.2.

Shell Diala. 682,236. Class 17. Insulating oils for electrical purposes. Shell Mex and B.P., Ltd., St. Helen's Court, Great St. Helen's, London E.C.3.

MEETINGS TO NOTE

THURSDAY, JANUARY 12

INST. HEATING AND VENTILATING ENGRS. (Birmingham branch).—"Electrical Systems of Temperature Control." T. Jackman, Imperial Hotel, Birmingham.—6.30 p.m.

I.E.E. (Radio section).—"Radar Echoes from Precipitation." J. E. N. Hooper and A. A. Kippax. Institution Building, Savoy Place, W.C.2.—5.30 p.m.

I.E.E. (N.E. Scotland sub-centre).—"The Measurement of Light and Colour." G. T. Winch, Royal Hotel, Union Street, Dundee.—7 p.m.

FRIDAY JANUARY 13

E.P.E.A. (Southern Meter Engs. group).—"Cleaning by Trichlorethylene." C. F. Ditchfield. Tudor Room, Caxton Hall, S.W.1.—6.30 p.m.

I.E.S. (Birmingham centre).—"Symposium of Papers." Imperial Hotel, Temple Street, Birmingham.—6 p.m.

ASSN. MINING, ELECTRICAL AND MECH. ENGRS. (S. Wales branch).—"Power Measurement at Collieries." T. L. Price. School of Mines, Pontypridd.—6 p.m.

I.E.E. (West Wales sub-centre).—Faraday Lecture: "Radar." R. A. Smith. Brangwyn Hall, Swansea.—6.30 p.m.

I.E.E. (N.E. Scotland sub-centre).—"The Measurement of Light and Colour." G. T. Winch. Robert Gordon's Technical College, Aberdeen.—7.30 p.m.

A.S.E.E. (Nottingham branch).—"Electronics in Industry." F. E. Noakes. Spread Eagle Hotel, Goldsmith Street, Nottingham.—8 p.m.

Man. Assn. Engrs.—"Recent Developments in Electric Winder Practice.' H. W. C. Liddiard. Engineers' Club, Albert Square, Manchester 2.—6.45 p.m.

SATURDAY, JANUARY 14

Assn. Mining Electrical and Mechanical Engrs.—"Overhead Transmission." H. V. Nunn. Queens Hotel, Barnsley.—3 p.m.

MONDAY, JANUARY 16

Birmingham Electric Club.—"The Cavendish Laboratory and Some of its Radio Work." A. J. Ratcliffe. Grand Hotel, Birmingham.

I.E.E. (Western Supply Group).—"The Performance of the British Grid System in Thunderstorms." J. S. Forrest. S. Wales Institute of Engrs., Park Place, Cardiff.—6.pm.

I.E.E. (London meeting).—"Discussion on Discussions." C. O. Boyse, Institution, Savoy Place, W.C.2.—5.30 p.m.

A.S.E.E. (Central London branch).—"Paper Insulated Cables." H. E. Tickner. St. Ermins Hotel, London S.W.1.—6.50 p.m.

A.S.E.E. (Stockport branch).—"Resistance Welding.' White Lion Hotel, Underbank, Stockport.—8 p.m.

TUESDAY, JANUARY 17

A.S.E.E. "The Electrical Equipment of a Modern Film Studio." H. Clifton. Lighting Service Bureau, 2 Savoy Hill, W.C.2.—6.30 p.m.

WEDNESDAY, JANUARY 18

Inc. Plant Engrs. (Western branch).—"Routine Inspection and Maintenance of Industrial Refrigeration Plant." Commander G. C. T. Turner. Grand Hotel, Bristol.—7.15 p.m.

Instn. Radio Engrs. (N. Eastern section).—"Activities and Equipment of an Industrial Electronic Laboratory." A. H. Hickling, Neville Hall, Westgate Road, Newcastle-on-Tyne.—6 p.m.

I.E.E. (N. Western centre).—"Some Considerations in the Design of Negative-Feedback Amplifiers." W. T. Duerdoth. Engineer's Club, Albert Square, Manchester.—6.30 p.m.

Inst. Physics. (London branch).—"Windmills as Electrical Power Generators." E. W. Golding, Institute House, 47 Belgrave Square, S.W.1.—5.30 p.m.

I.E.S. (Swansea group).—"Industrial Lighting." M. W. Peirce. Y.M.C.A., Swansea.—6 p.m.

I.E.E. (Southern centre).—"The Performance of the British Grid System in Thunderstorms." J. S. Forrest. Technical College, Brighton.—6.30 p.m.

I.E.E. (S. Midlands students).—"Insulation, A Practical Treatise." R. E. R. Crick. G.E.C. Telephone Works, Uxbridge Avenue, Coventry.—7.30 p.m.

I.E.E. (London meeting).—Faraday lecture "Radar." R. A. Smith, Central Hall, Westminster.—6.30 p.m.

A.S.E.E. (Coventry branch). — "Electronics in Industry." Mr. L. G. Ward. Technical College, The Butts, Coventry.—7 p.m.

THURSDAY, JANUARY 19

E.P.E.A. (Midland technical group).—"Power Stations, Past and Present." F. W. Lawton, Wolverhampton.—7 p.m.

Instn. Radio Engrs. (London section).—"The Performance and Stability of Permanent Magnets." A. J. Tyrell. London School of Hygiene, Keppel Street, W.C.1.—6.30 p.m.

I.E.E. (Irish section).—"Some Aspects of Agriculture and Horticultural Electrification in N. America." F. E. Rowland. Trinity College, Dublin.—6 p.m.

FRIDAY, JANUARY 20

I.E.E. (Southern centre).—Faraday lecture "Radar." R. A. Smith. Guildhall, Southampton.—6.30 p.m.

SATURDAY, JANUARY 21

I.E.E. (N. Midlands students).—Problems afternoon. Yorkshire Electricity Board Offices, Market Street, Huddersfield.—2.30 p.m.

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TENDERS INVITED

BEDFORDSHIRE COUNTY COUNCIL

Education Committee

North Bedfordshire College of Further Education, Cauldwell Street, Bedford.

TO:—ELECTRICAL ENGINEERS.

Electrical engineers desirous of tendering for the installation of ELECTRIC LIGHT, etc., in accordance with drawings and specification, to the additional accommodation at the above college, are requested to submit their names and addresses, together with a deposit of £2 2s. to the County Architect, Shire Hall, Bedford, not later than Monday, January 23, 1950.

The deposit, which should be made payable to the County Treasurer, is returnable on receipt of a bona-fide tender or return of all documents.

Tenders are to be delivered to the undersigned on the prescribed form in sealed and endorsed envelopes by the date which will be notified when the tender documents are despatched.

The Committee do not bind themselves to accept the lowest or any tender.

J. B. GRAHAM,
Clerk of the County Council.

Shire Hall, Bedford. (D 367)

CITY OF PETERBOROUGH

THE Council invites tenders from recognised electrical contractors for the ELECTRIC LIGHTING AND POWER INSTALLATIONS to 76 permanent houses on the Dogsthorpe/Newark Estate, Peterborough.

Drawings, specifications and forms of tender may be obtained on application to F. J. Smith, M.B.E., A.M.I.C.E., City Engineer and Surveyor, Town Hall, Peterborough.

Applications, before noon on January 21, 1950, should be accompanied by a cheque to the value of £2 2s., made payable to the Peterborough City Council, which will be returned on receipt of a bona-fide tender or the return of the documents.

The Council does not bind itself to accept the lowest or any tender.

ARTHUR J. REEVES,
Town Clerk.

Town Hall, Peterborough.
January, 1950. (D 354)

COUNTY BOROUGH OF BELFAST

Electricity Department

STORES

TENDERS are invited for the supply of the undermentioned stores:—

Form No.	
1.	Turbine oil.
6.	Glazed stoneware ducts and troughing, fibre ducts and covering tiles.
9.	Feeder and section pillars.
11.	Meters and instrument transformers.
18.	Electric washboilers.
19.	Electric kettles.
22.	Bare hard drawn H.C. copper conductors and P.B.J. insulated cables.
24.	Transformer kiosks with high and low tension switchgear.
28.	Bitite strip, prepared tape and rubber tape for joints, joint box compounds and refined bitumen.
31.	Oilskin coats, tarpaulins, rubber jointing, etc.
33.	Nickel-iron switch tripping batteries and charging equipments.
34.	6,600 V ring main and switch fuse units.
35.	Underground cable disconnecting boxes with pavement frames and covers.
36.	Electric cooker circuit accessories.
37.	Boiling plates for electric cookers.

Note.—Form No. 31 is in respect of materials which shall be supplied to any department of the Corporation.

Forms of tender and further particulars may be obtained from the Electricity Department, East Bridge Street, Belfast.

Each tender, in sealed envelope marked "Tender for Stores, Electricity Department," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, February 3, 1950.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
January 6, 1950. (D 368)

APPOINTMENTS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of ASSISTANT SECTION ENGINEER in the Bushbury Section of the Transmission Department, located near Wolverhampton. The salary will be within the range of £471 3s. to £602 8s. per annum.

Applicants should preferably hold corporate or graduate membership of the Institution of Electrical Engineers or equivalent qualifications, and should have considerable experience in the operation and maintenance of high voltage transmission lines, cables, switching and transforming stations up to 132 kV.

The salary quoted is to be regarded as provisional until the final scales have been negotiated with such organisations as are appropriate, and superannuation will be under terms and conditions approved by the British Electricity Authority.

Applications should be made on forms obtainable from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and be returned not later than January 28, 1950.

F. W. LAWTON,
Divisional Controller.
(D 316)

SOUTH EASTERN GAS BOARD

VACANCIES exist within the Board for ELECTRICAL SUPERINTENDENTS.

Applicants should be corporate members of the Institution of Electrical Engineers or hold equivalent qualifications and be experienced in the installation, operation and maintenance of all types of a.c. and d.c. motors and control gear, turbine and engine driven generating plant, mercury-arc rectifiers, transformers and main switchgear, and should have some knowledge of the design of power distribution systems.

The salary offered will not be less than £650 per annum.

The successful applicant will be required to pass a medical examination.

Applications, stating age, qualifications, experience, etc., accompanied by two copies of recent testimonials, should reach the undersigned not later than 14 days from the date of publication of this notice.

R. J. McCRAE,
Personnel Manager.

Katharine Street, Croydon. (D 361)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT DISTRIBUTION ENGINEER, Folkestone. Provisional salary £596 per annum under N.J.B. Class "F", Grade 5. Applicants should preferably be Corporate members of the I.E.E. and must have sound technical education and experience in all work associated with a distribution department. Consideration will be given to the following: experience in design, construction and maintenance of 11 kV and medium pressure overhead and underground transmission systems and substations; public lighting schemes; the preparation of specifications and estimates; experience in the handling of engineering personnel. Applications, giving two referees, must reach P. V. Gurr, Esq., J.P., District Manager, South Eastern Electricity Board, York House, Cheriton Gardens, Folkestone, Kent, by January 23, 1950.

SECRETARIAL ASSISTANT, Area Board Headquarters, Hove. Provisional salary £450-£600 per annum within grade "D" of the N.J.C. (Administrative and Clerical Grades) Interim Scheme of Salaries. Applicants should possess a sound knowledge of general secretarial practice and be capable of preparing agenda, minutes and reports of meetings. The person appointed will be seconded for duty with the South Eastern Electricity Consultative Council. Applications, giving two referees, endorsed "Secretarial Assistant" must reach The Secretary, South Eastern Electricity Board, 10 Queen's Gardens, Hove 3, Sussex, by January 23, 1950.

Superannuation will be arranged for these positions.

A. L. BURNELL,
Secretary.

January, 1950. (D 355)

SOUTH WESTERN ELECTRICITY BOARD

THE Board invite applications from suitably qualified persons for the following appointments:—

Bristol and North Somerset Sub-Area

(a) DISTRIBUTION ENGINEER (Headquarters Bristol). Provisional commencing salary £1,017(Grade 3, Class "M")
Candidates should have had a thorough electrical engineering training and considerable experience in all matters connected with the development, operation and maintenance of an efficient supply system.
The successful candidate will be responsible for all mains and sub-stations work in the sub-area, which is a combination of heavily loaded commercial and industrial properties and residential and rural districts.
(b) PLANNING, DRAWING OFFICE AND WAYLEAVES ENGINEER (Headquarters Bristol)
Provisional commencing salary £805 (Grade 6, Class "M")
Candidates should be well experienced in laying out supply systems covering large urban districts, small townships and new housing estates; the planning and design of buildings and o.h. and u.g. 33 kV systems; wayleave negotiations and procedure.
The successful candidate will be responsible for planning and initiating works and extensions in the sub-area including maintenance of records and preparation of plans; design and maintenance of buildings; design of o.h. lines and including surveys and obtaining wayleaves.
For these appointments candidates should possess an engineering degree, or be Corporate Members of the I.E.E.

Taunton and West Somerset Sub-Area

(a) ASSISTANT DISTRICT ENGINEER, BRIDGWATER (Headquarters Bridgwater)
Provisional commencing salary £559 (Grade 5, Class "E")
(b) ASSISTANT DISTRICT ENGINEER, MINEHEAD (Headquarters Minehead)
Provisional commencing salary £464 (Grade 5, Class "B")
Candidates should have had extensive experience of 11 kV, 3-ph. systems in urban rural areas.
The successful applicants will be responsible for the initiation of system improvement schemes, forward planning, maintenance or protective gear and fault location and for maintenance and operation of district transport.
(c) CONSTRUCTION ENGINEER, TAUNTON DISTRICT (Headquarters Taunton)
Provisional commencing salary £479 (Grade 8, Class "F")
Candidates should have had experience in the survey and construction of o.h., 11 kV and MV/LV lines in rural areas: the successful applicant will be required to supervise new o.h. and u.g. engineering projects including preparation of surveys, procurement of wayleaves and estimating extensions.
(d) INSTALLATION AND CONTRACTING ENGINEER, TAUNTON DISTRICT (Headquarters Taunton)
Provisional commencing salary £449 (Grade 8A, Class "F")
(e) INSTALLATION AND CONTRACTING ENGINEER, BRIDPORT DISTRICT (Headquarters Bridport)
Provisional commencing salary £374 (Grade 8A, Class "C")
Candidates should have had experience in electrical contracting, preparation of specifications, estimates, installation and maintenance of consumers' appliances and have knowledge of direct sales and hire purchase negotiations.
Technical qualifications appropriate to these posts will be considered an advantage.
The salaries for all these posts are provisional pending the adoption of nationally negotiated scales.
Detailed applications stating for which post(s) the candidate desires to be considered to be sent to the Assistant Secretary (Establishments), South Western Electricity Board, Electricity House, Colston Avenue, Bristol 1, within 10 days. (D 365)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of MECHANICAL MAINTENANCE ENGINEER at the Percival Lane Power Station, Runcorn.
The salary will be in accordance with Class " J," Grade 6 of the National Joint Board Schedule, at present £662 per annum, rising to £691 per annum, and should be regarded as provisional, subject to negotiation with the appropriate organisation.
Applicants should be Associate Members of the Institute of Mechanical Engineers or possess equivalent technical qualifications and must have had a wide experience in the mechanical maintenance of power station plant.
The appointment will be subject to medical examination and superannuation under terms and conditions approved by the British Electricity Authority.
Forms of application can be obtained from the Divisional Secretary, British Electricity Authority, Merseyside and North Wales Division, Clarke Gardens, Woolton, Liverpool, and should be returned in a sealed envelope endorsed in the top left-hand corner " Mechanical Maintenance Engineer," so as to be received not later than first post on Tuesday, January 24, 1950. (D 317)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ELECTRICAL FITTER

APPLICATIONS are invited for the appointment of Electrical Fitter in the Warrington District of the Board's No. 2 Sub-Area.
Applicants should have served an apprenticeship and have had several years' subsequent experience as a journeyman.
The position is governed by the National Joint Industrial Council for the Electricity Supply Industry, and the present rate of pay is 35.00d. per hour.
Applications, stating age, qualifications, experience and present appointment should be addressed to the Manager, No. 2 Sub Area, Merseyside and North Wales Electricity Board, Sandiway House, near Northwich, Cheshire, so as to be received not later than January 24, 1950.
The envelope should be endorsed "Electrical Fitter—Warrington."

JAMES RANKIN,
Secretary.
(By permission of the Ministry of Labour under the Control of Engagements Order 1947)
(D 356)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the position of ACCOUNTANCY ASSISTANT (Superannuation).
The successful applicant should have experience in the maintenance of records, and have a good knowledge of superannuation procedure, preferably within the electricity supply industry.
The salary for this appointment will be within the interim salary range Grade "B," £450-£550 per annum, and will be subject to the successful applicant entering the authority's superannuation scheme.
Applications should be submitted on the official form of application which may be obtained from the Divisional Establishments Officer, at the undermentioned address, and should be returned not later than January 23, 1950.

W. S. BURGE,
Divisional Controller.
British Electricity House,
Barker Gate, Nottingham. (D 348)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the position of SECOND ASSISTANT ENGINEER on the staff of the Generation Engineer (Construction) at Divisional Headquarters, Portsmouth.
Applicants must have had sound technical training as mechanical and electrical engineers and be corporate members of the Institution of Mechanical and/or Electrical Engineers or hold suitable equivalent qualifications.
Experience in the construction of large generating stations is essential and experience in a large manufacturing works and of station operation is desirable.
The salary, which is provisional and subject to negotiation, will be within the range £707-£838 p.a.
Forms of application may be obtained from the undersigned and must be returned not later than 10 a.m. on Tuesday, January 31, 1950.

P. D. A. OLIVER,
Divisional Secretary.
British Electricity House,
High Street, Portsmouth. (D 354a)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment :—

ASSISTANT CONTROL ENGINEER

Little Barford Generating Station. Salary in accordance with N.J.B. Schedule Grade 10b, Class " J " (£347-£360 per annum).
Preference will be given to applicants who have had previous experience in the operation of a switchboard at a generating station, and who have reached the standard of ordinary National Certificate in Electrical Engineering or its equivalent.
The salary is in accordance with the scale at present operating, but may be subject to negotiation through the medium of the Joint Board.
The appointment will be superannuable in accordance with the British Electricity Authority and Area Board Superannuation Scheme.
Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than January 20, 1950. Envelopes should be endorsed "Assistant Control Engineer," Little Barford.

W. N. C. CLINCH,
Controller.
Northmet House, Southgate, N.14. (D 295)

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE

JUNIOR SHIFT CHARGE ENGINEER required for Electric Traction Sub-station. Must have experience in the operation of rotary converters, mercury arc rectifiers, also h.t. and l.t. switchgear. Experience with sub-station supervisory control equipment will be an advantage.

Salary in accordance with Grade 1 of the Miscellaneous Division of the National Joint Council for Local Authorities' Services, commencing at £315 per annum, rising by annual increments to £360 per annum.

The successful applicant will be required to pass a medical examination and to contribute to the Corporation's Superannuation Scheme.

Applications should be addressed to the undersigned and received not later than January 24, 1950.

F. S. TAYLOR, M.Inst.T.,
General Manager.

Transport and Electricity Undertaking,
Manors, Newcastle-upon-Tyne 1. (D 275)

SOUTHERN ELECTRICITY BOARD

No. 3 (Portsmouth) Sub-Area

APPLICATIONS are invited for the appointment of LINESMEN (Overhead Power) in the No. 3 (Portsmouth) Sub-Area at Aldershot and Portsmouth. Applicants should have experience in the erection of h.v. and l.v. overhead transmission and distribution lines, having wood pole supports.

The wages and conditions of service are as set out in the National Joint Industrial Council's Agreement for the electricity supply industry.

Applications, stating the district preferred, should be made in writing to the Sub-Area Secretary, Southern Electricity Board, Lower Drayton Lane, Cosham, Portsmouth, by not later than January 31, 1950. (D 294)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the position of ASSISTANT CHARGE ENGINEER at Stuart Street Generating Station, Bradford, Manchester.

Candidates must have had a good technical training and possession of technical qualifications is desirable. Experience in the operation of a large modern power station will be an advantage.

The salary will be in accordance with the N.J.B. Schedule, Class "K," Grade 8a, i.e., £564-£588 per annum.

Applications, stating age, qualifications and full details of experience should be received by The Establishment Officer, British Electricity Authority, "Woodlands," Woodlands Drive, Offerton, Stockport, Cheshire, not later than seven days after the appearance of this advertisement. (D 362)

MINISTRY OF SUPPLY

THE Ministry of Supply invite applications for the following appointments in the Division of Atomic Energy (Production):

At Risley, near Warrington, Lancs.

1. CHIEF POWER SERVICES ENGINEER to be responsible for the design and layout of all steam and electrical services for large factories. The duties will entail the preparation of equipment specifications, installation planning, and close co-operation with the plant and production managers. He will be required to advise on the most suitable electrical equipment for the Division's production processes.

2. ELECTRICAL ENGINEER to be responsible for electrical installation design work on large factories with grid intake. Applicants should be thoroughly conversant with 11 kV or 6.6 kV factory distribution, design of static transformer substations and low voltage a.c. distribution systems. Experience of power and lighting installations in factory and ancillary buildings is required.

Candidates must either hold an engineering degree of a recognised university, or be corporate members of one of the Institutions of Civil, Mechanical or Electrical Engineers. They must have served an engineering apprenticeship. Only very exceptional experience in the duties specified above will be considered in lieu of these qualifications.

For post 2 applications will also be accepted from candidates who have examinations recognised by any of these institutions as granting exemption from Sections A and B of their examinations for associate membership.

Salaries will be assessed according to experience and qualifications on the following inclusive ranges :—Post 1, £1 240 to £1,750 per annum. Post 2, £720 to £960 per annum.

Candidates will normally be confined to natural born British subjects, born within the United Kingdom or one of the self-governing dominions, of parents similarly born.

Applications, specifying post and giving full particulars of qualifications and experience should be sent to the Administrative Branch, Ministry of Supply, Division of Atomic Energy (Production), Risley, near Warrington, Lancs. (D 337)

NORTH WESTERN ELECTRICITY BOARD

Area Board Headquarters

TESTING ASSISTANT

APPLICATIONS are invited for the position of Testing Assistant in the Technical and Research Department Area Testing Station, Sherbourne Street, Manchester.

The provisional salary will be within the range of £400-500 per annum in accordance with Grade 3 of the Board's scale of salaries.

Applicants should have had experience in testing of : Meters, instruments, relays, instrument transformers and miscellaneous testing.

Candidates should hold the Higher National Certificate in Electrical Engineering or its equivalent.

Applications, stating age, full details of training, technical qualifications and experience should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than January 26, 1950. (D 340)

SOUTHERN ELECTRICITY BOARD

No. 3 (Portsmouth) Sub-Area

APPLICATIONS are invited for the position of ASSISTANT SUB-STATIONS ENGINEER in the Portsmouth district of the No. 3 (Portsmouth) Sub-Area.

Applicants should have experience in the erection, operation and maintenance of fuses and switchgear up to and including 11 kV 3-phase; installation, maintenance and connection of transformers; testing and maintaining of protective gear. Work in connection with indoor and outdoor sub-stations, including the necessary records. Experience with rotary converting plant would be an advantage. Applicants should preferably be Corporate Members of the I.E.E. or hold qualifications admitting to that class of membership.

The provisional commencing salary will be £461 per annum on Class "J," Grade 9, of the N.J.B. Schedule, subject to adjustment by the appropriate negotiating machinery, with N.J.B. conditions of service. The successful applicant will, subject to certain conditions, be required to contribute to the staff superannuation scheme, membership of which is compulsory.

Applications should be submitted to the Sub-Area Secretary, Southern Electricity Board, Lower Drayton Lane, Cosham, Portsmouth, in envelopes endorsed, "Assistant Sub-Stations Engineer, Portsmouth," within a fortnight from the date of publication of this advertisement. (D 351)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified candidates for the following appointments :—

Chilterns Sub-Area

DISTRICT COMMERCIAL OFFICER—LUTON 4/50

Applicants, preferably Corporate Members of the Institution of Electrical Engineers, should have had wide practical experience. The successful candidate will be responsible to the District Manager for all commercial aspects of a large district having an important industrial, agricultural, commercial and domestic consumer population.

Ability to deal with problems arising from electrical contracting and maintenance, tariffs, rural and industrial extensions and an active sales programme, and to supervise commercial staff is essential. Ability to drive a car will be advantageous.

The provisional salary for this appointment will be £840 a year.

Applications should be addressed to: The District Manager, Luton, Chilterns Sub-Area, Eastern Electricity Board, Dunstable Road, Luton.

Northmet Sub-Area

ENGINEERING ASSISTANT—HENDON DISTRICT 5/50

Applicants should have a sound training, preferably to Higher National Certificate standard in electrical engineering and experience in the construction, operation and maintenance of 3-phase distribution systems up to 11 kV.

The provisional salary will be in accordance with Class "H," Grade 9A, of the N.J.B. Schedule, viz. £418 a year.

Application forms may be obtained from: The District Manager, Hendon, Northmet Sub-Area, Eastern Electricity Board, 137/139 Brent Street, Hendon, N.W.4.

All salaries quoted are provisional and future salaries and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, stating age, education, experience and fullest details, including whether married or single, and the names of two referees, should reach the district managers concerned within fourteen days of the appearance of this advertisement. (D 350)

NORTH WESTERN ELECTRICITY BOARD

Area Board Headquarters

SENIOR TESTING ASSISTANT

APPLICATIONS are invited for the position of Senior Testing Assistant in the Technical and Research Department of the Area Testing Station, Sherbourne Street, Manchester.

The provisional salary will be within the range of £650-£900 per annum in accordance with Grade I of the Board's scale of salaries.

Applicants should have had experience in: High voltage testing generally, including Impulse testing of transformers, testing of transformer bushings, etc.

Candidates should hold the Higher National Certificate in Electrical Engineering or its equivalent.

Applications, stating age, full details of training, technical qualifications and experience, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than January 28, 1950. (D 339)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the position of CLERICAL ASSISTANT in the purchasing department of the secretary's office.

The successful applicant should have experience in the buying of all types of electrical and mechanical parts and general stores as applied particularly to generating stations, transmission lines and sub-stations.

The salary for this appointment will be within the interim salary range Grade "B," £450-£550 per annum, and will be subject to the successful applicant entering the authority's superannuation scheme.

Applications should be submitted on the official form of application which may be obtained from the Divisional Establishments Officer, at the undermentioned address, and should be returned not later than January 23, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity House,
Barker Gate, Nottingham. (D 349)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of JUNIOR SHIFT CHARGE ENGINEER, at the St. Helens Generating Station.

The salary which is provisional pending negotiations between the authority and the appropriate association will be in accordance with the National Joint Board Schedule, the appointment being in Class "H," Grade 9, i.e. £437 per annum, rising to £453 per annum.

The appointment will be subject to medical examination and superannuation under terms and conditions approved by the British Electricity Authority.

Applicants must have qualifications at least up to Higher National Certificate Standard and have had experience in the shift operation of generating plant.

Forms of application may be obtained from the Divisional Secretary, British Electricity Authority, Merseyside and North Wales Division, Clarke Gardens, Woolton, Liverpool and should be returned to him in a sealed envelope so as to be received not later than the first post on Thursday, January 26, 1950. (D 342)

BRITISH ELECTRICITY AUTHORITY

London Division

BOILER HOUSE ENGINEER—DEPTFORD EAST POWER STATION

APPLICATIONS are invited for the position of Boiler House Engineer in charge of shift operation at Deptford East Power Station.

Candidates should have received a sound technical training and preferably have gained National or Higher National Certificate in either electrical or mechanical engineering. Candidates must also have received good engineering training and have had experience of the operation of modern boiler plant and its auxiliaries, and in combustion of solid fuels.

Salary in accordance with N.J.B. Schedule, Class "K," Grade 6.

The appointment will be subject to the superannuation scheme and conditions of service of the authority.

Applications, stating age, qualifications and experience, should be addressed to the Acting Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, and be received within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(D 345)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of an ASSISTANT DOMESTIC ENGINEER in the Purchasing Department of the Head Office of the Board at St. Mellons.

Applicants should preferably have had experience in all branches of domestic electrical engineering, including installation work, domestic appliances and street lighting fittings. Commercial experience is equally important and will be an additional advantage.

The salary for the position is provisional until such time as the final grading is determined by the appropriate negotiating machinery, and will be within the range of £600-£650 per annum according to qualifications and experience.

Applications, stating age, present position, present salary, qualifications, experience, whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments Section), The South Wales Electricity Board, St. Mellons, near Cardiff, so as to reach him not later than January 21, 1950. (D 353)

A VERY large provincial engineering firm, mass producing a variety of products, require a CHIEF INSPECTOR with the following qualities:—

(1) He must be a first-class leader with a past record to substantiate the fact.

(2) He must have organising ability of the highest order.

A substantial salary will be paid to the right man. When replying please quote reference N/6, Box No. 1687, Electrical Times. (D 251)

APPLICATIONS are invited from ELECTRICAL ENGINEERS with a sound knowledge of switchgear, for appointments at the Nelson Research Laboratories, Stafford. A degree in electrical engineering and an interest in development are desirable. Duties will include short-circuit testing of switchgear.—Write, giving full details of age, qualifications, and experience, quoting Ref. No. 299, to Central Personnel Services, English Electric Co., Ltd., 24 Gillingham Street, Westminster S.W.1. (D 277)

APPLICATIONS are invited from men 25 to 35 for post of SALES REPRESENTATIVE for Burco Electric Wash Boilers, in the area covered by the South Wales and South Western Electricity Boards. Candidates should be resident in the area and be of good education and appearance, preferably having connections with districts of the electricity boards and electrical wholesalers. Good salary and expenses with further prospects.—Full details as to character and experience to: Burco Ltd., Rose Grove, Burnley. (D 344)

APPLICATIONS (male or female) are invited for the following positions, with well-known London electrical wholesalers. (E.W.F.) Some electrical experience is desirable. Good salaries, superannuation, profit-sharing.

(1) PRICING ASSISTANT understudy to sectional head.

(2) CLERICAL ASSISTANT in pricing section.

(3) ORDER CLERK used to handling telephone enquiries, progressing orders, etc.

(4) STORES ASSISTANT (male only).

Present staff know of this advertisement.—Write, fullest details to Managing Director, Box No. 1709, Electrical Times. (D 333)

AREA REPRESENTATIVE required by manufacturers distribution gear, to take over large connection and operate throughout area boards 3, 4, 7 and 8. Knowledge of overground and underground distribution systems.—Write, with full details age, experience, previous appointments and qualifications, to Box No. 1701, Electrical Times. (D 310)

ASSISTANT ENGINEERS for lighting development. Applicants should have technical qualifications admitting to corporate membership of the I.E.E. and must have experience or training in public speaking. Successful candidates must be prepared to be appointed to the provinces after an initial period in London. Age 25-35.—The Electric Lamp Manufacturers' Association of Great Britain, Ltd., Lighting Service Bureau, 2 Savoy Hill, London W.C.2. (D 369)

AUSTRALIAN ENGINEER. A vacancy exists within the organisation of a well-known firm of engineers specialising in the design and installation of steam generating plants and associated equipment for a well-trained engineer having some considerable experience in the above field. He will be required to take up permanent residence in New South Wales, Australia, acting in the capacity of Assistant Resident Engineer in the first place, with the possibility of later promotion to the post of Resident Engineer in Charge of contract work on site.

Australian birth would be an advantage.

Applicants must be of the Higher National Certificate education standard and corporate membership of a recognised professional institution would be of benefit.

First-class passage for successful applicant and family to Australia would be paid together with expenses whilst in transit.

Salary according to age and experience, but not less than £A.750 per annum.

Detailed applications, stating age, previous experience, previous employers and technical qualifications to Box No. 1719, Electrical Times. (D 370)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

BRITISH STANDARDS INSTITUTION requires a chartered member of the Institution of Electrical Engineers under 45 years of age, to act as SECRETARY to a group of committees dealing with electrical subjects. Salary according to qualifications and experience.—Applications to be made in writing to The Director, British Standards Institution, 28 Victoria Street, S.W.1, the envelope being marked "Technical Assistant." Applications will be acknowledged only if an interview is desired. (D 352)

CHARGE SHIFT ENGINEER required for industrial power station. Applicants should, in addition to technical training, have had good experience in the operation of power station plant, including high and low pressure boilers, turbo alternators, e.h.t., and l.t. switchgear. Salary schedule according to Class "G," at present £505 per annum commencing. Applications should be accompanied by copies of recent testimonials, and give age and details of training, qualifications, experience, etc., and addressed to the Chief Engineer, Slough Estates Ltd., Trading Estate, Slough. (D 261)

CHIEF DRAUGHTSMAN required by manufacturers of electric control gear. Extensive knowledge of subject with ability to direct staff essential. London area.—Reply, with full details and salary expected, to: Box No. 1703, Electrical Times. (D 328)

COOKE AND FERGUSON LTD. require SENIOR AND JUNIOR DRAUGHTSMEN for interesting high voltage switchgear development projects. Good prospects for the right men.—Apply, stating age, experience, and salary required, to the Personnel Manager, Messrs. Cooke and Ferguson Ltd., South Street, Openshaw, Manchester 11. (D 323)

DRAUGHTSMEN wanted with experience of layout and/or design of automatic motor control gear and l.t. switchgear. Good prospects, good and cheap hostel accommodation available for unmarried men. A.E.S.D. rates. Location within 30 miles of Bristol (Somerset side).—Apply, stating age and experience, Box No. 1667, Electrical Times. (D 183)

EDITOR required by a company situated in S.E. London district for telecommunications technical journal, instruction manuals, parts lists, etc. Must have electrical background and evidence of publication. Initial salary £500 p.a.—Write, giving full particulars, to: Box No. Y5514, A.K. Advg., 212a Shaftesbury Avenue, W.C.2. (D 314)

ELECTRICIAN WIREMAN required, experienced all systems.—Apply in writing, Giffords, Basingstoke. (D 271)

ENFIELD CABLES LTD. require an experienced FOREMAN to take charge of supertension cable contracts in South England Area.—Applications to: Area Engineer, Lockfield Avenue, Brimsdown, Enfield, Middlesex. (D 312)

FERRANTI LTD. invite applications from well-qualified ENGINEERS with experience in the design, or operation, of special purpose metering equipment. The successful applicant is required to assist in formulating design policy and to take charge of a development section engaged in this type of work. He will also be required to give technical advice to customers and plan metering schemes to meet individual requirements. The position is one of great interest and carries prospects of promotion. Salary will be in the range of £900 to £1,300 per annum.

Application forms from the Staff Manager, Ferranti Ltd., Hollinwood, Lancs. (D 364)

FLUORESCENT Lighting Fittings Manufacturers, producing extensive range of industrial fittings, require additional REPRESENTATIVES with established entree to large users and contractors. Experience of illumination essential. Only men with proved sales record and used to substantial earnings considered.—Box No. 1715, Electrical Times. (D 343)

IMPERIAL CHEMICAL INDUSTRIES LIMITED, ALKALI DIVISION, NORTHWICH, has vacancies for ELECTRICAL DRAUGHTSMEN. Applicants must have the Higher National Certificate (Electrical) or equivalent, and must be capable of turning out a good drawing and making layout drawings for industrial electrical equipment and distribution schemes. Salary will be discussed at interview. Housing in pleasant rural area can in certain cases be made available within 3 to 4 months of commencing employment.—Applications should be addressed to Staff Manager, Imperial Chemical Industries Limited, Alkali Division, Winnington, Northwich, Cheshire. (D 346)

JUNIOR TECHNICAL ENGINEERS required for electrical manufacturers' works in Home Counties. Applicants, preferably aged 20/25, must have received practical and theoretical training and must be prepared to travel in U.K. Position involves technical correspondence mixed with service work with prospects of promotion to technical sales engineers.—Replies to Box No. 1679, Electrical Times. (D 206)

LEADING (E.L.F.A.) manufacturers of electric light fittings require experienced DESIGNER-DRAUGHTSMAN. Applicants must be familiar with manufacturing methods, particularly for fluorescent fittings, and be capable of producing detailed manufacturing drawings from appearance designs or specifications.—Applications, stating age, experience, and salary required should be addressed to Box No. 1683, Electrical Times. (D 242)

MANUFACTURERS of electrical cooking and heating equipment require DRAUGHTSMAN for industrial design and development work. Birmingham.—Reply, stating age, experience, and salary to Box No. 1717, Electrical Times. (D 359)

OIL refinery specialists require a professionally qualified ELECTRICAL ENGINEER capable of taking charge of a section dealing with all phases of electrical engineering, including equipment, power, lighting and instrumentation. A sound knowledge of electrical codes and full experience in the above type of work is necessary.—Box No. 1725, Electrical Times. (D 374)

OLD-ESTABLISHED London firm of electrical insulating engineers require REPRESENTATIVE for Manchester area; good prospects for right applicant.—Write, stating age, full details of experience and salary required, to: Anglo-American Vulcanised Fibre Co. Ltd., 21 Bath Street, London E.C.1. (D 315)

OUTSIDE SALES ENGINEER for power factor correction capacitors, London and Home Counties. Salary and commission, depending on qualifications.—Secretary, Bryce Electric Construction Co. Ltd., Hackbridge, Wallington, Surrey. (D 331)

PILKINGTON BROTHERS LTD., Glass Manufacturers, require an ASSISTANT ELECTRICAL ENGINEER (not over 30 years of age) for the installation and maintenance of a large electrical plant in the North of England. Applicants should possess a University Degree in Electrical Engineering, should be a Graduate of the Institution of Electrical Engineers, and should have at least two years' practical experience. Salary according to age and qualifications.—Applications should be addressed to the Chief Personnel Officer, Pilkington Brothers, Ltd., St. Helens, Lancashire. (D 325)

POWER CABLES RESEARCH. A Senior Vacancy exists in the Research Laboratories of British Insulated Callender's Cables Limited, which are mainly situated in West London, for a man, preferably with a good electrical engineering or physics degree, to take charge of research projects relating to impregnated paper cables, including pressure and oil filled cables, up to the highest voltages. Salary range from £1,000 to £1,500 starting position dependent upon age, experience and qualifications. Applications in envelopes marked "Personal" should be sent to: The Director of Research, British Insulated Callender's Cables Limited, 38 Wood Lane, London W.12. (D 245)

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SWITCHGEAR DRAUGHTSMAN. Capable senior required for contract work on h.t. metalclad gear. Full details of experience and technical education to South Wales Switchgear, Ltd., Blackwood, Monmouthshire. Salary commensurate with ability. House available. *(Advertisement by permission of the Ministry of Labour and National Service under the Control of Engagement Order 1947).* (D 258)

TECHNICAL ASSISTANT required for Lighting Department of large firm of electrical manufacturers. Applicants should possess National Certificate in Engineering or equivalent qualification.—Write stating particulars of experience and salary required to Box No. 1711, Electrical Times. (D 334)

TECHNICAL ASSISTANT required with degree or Higher National Certificate (Elect.) with experience of induction motors and light electro mechanical mechanisms. Large industrial organisation West London.—Write, age education and experience to Box No. 1707, Electrical Times. (D 332)

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London Office: 333 Station Road, Harrow, Middlesex. Tel.: Harrow 2253.

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AERIALITE T.V. AERIALS, HI-CRAFT FLUORES, CENTS, CABLE, SWITCHGEAR, ETC., at keenest prices. Send 1d. stamp for lists.—Northern Industries Snow Hill, Manchester 4. (D 50)

INDEX TO ADVERTISERS

Aerospray Mfg. Co., Ltd. ... 54
Aerialite, Ltd. 8
Association of Steel Conduit Mfrs. 63

B.D.M. Engineering Co., Ltd. ... 76
Belling and Co., Ltd. 6
Benjamin Electric Co., Ltd. ... 33
Bill Switchgear, Ltd. 5
Birch, H. A. and Co., Ltd. ... 9
Birmingham Aluminium Casting (1903) Co., Ltd. 30
Bowker, S. O., Ltd. 80
British Electricity Authority ... 35
Brit. Institute of Engineering Technology 4
Brit. Ins. Callender's Cables, Ltd. 1
Brit. National Electrics, Ltd. ... 2
Brit. Thomson-Houston Co., Ltd. 81
Brit. Vacuum Cleaner and Engrg. Co., Ltd. 61
Brook Motors, Ltd. 34
Brush Elec. Engrg. Co., Ltd. ... 28

Carter, B. and F. Co., Ltd. ... 82
Clyde Blowers, Ltd. 68
Cobra (Wood Treatment), Ltd. 11
Connolly's (Blackley), Ltd. ... 65
Cox-Walkers, Ltd. 82
Crabtree, J. A. and Co., Ltd. ... 71
Cressall Mfg. Co., Ltd. 4
Crompton Parkinson, Ltd. ... 39

De La Rue, Thos. and Co., Ltd. 62
Drake and Gorham Wholesale, Ltd. 66
Duratube and Wire, Ltd. ... 14

Ekco-Ensign Electric, Ltd. ... 83
Electric Construction Co., Ltd. 20
Electropower Gears, Ltd. ... 74
Elexcel, Ltd. 23
Engrg. & Lighting Equip. Co., Ltd. 12
Essex Partners, Ltd. 76
Everett Edgecumbe, Ltd. ... 62

Ferranti, Ltd. 19
Fibreglass, Ltd. 13
Flexible Non-Metallic Conduits, Ltd. 66
Fry's Metal Foundries, Ltd. ... 40

Geipel, Wm., Ltd. 78
General Cable Mfg. Co., Ltd. ... 32
General Electric Co., Ltd. 31, 69
Genristo, Ltd. 64
Gunk (Bayard Publicity Ltd., Manchester) 70

Hackbridge and Hewittic Electric Co., Ltd. 55
Hague and McKenzie, Ltd. ... 60
Henley's W.T., Telegraph Works Co., Ltd. 17
Hoover, Ltd. 42

Jackson Boilers, Ltd. 37
Jackson Electric Stove Co., Ltd. 57
Johnson, Matthey and Co., Ltd. 43
Johnson and Phillips, Ltd. ... 75

Legg (Industries), Ltd. 70
Lindley Thompson Transformer and Service Co., Ltd. 24
Lipton Products, Ltd. 76
Litholite Insulators and St. Albans Mouldings, Ltd. 70
Liverpool Electric Cable Co., Ltd. 59

McKechnie Bros., Ltd. 74
Measuring Instruments (Pullin), Ltd. 68
Mersey Cable Works, Ltd. ... 38
Metro-Vickers Elec. Co., Ltd. 7, 44
Metway Elec. Industries, Ltd. ... 80
Mitchell Construction Co. ... 73
M.K. Electric, Ltd. 10
Mole, M. and Son, Ltd. 14
Mosses and Mitchell, Ltd. ... 78

Nevelin Electric Co., Ltd. ... 86
Newton Chambers and Co., Ltd. 64

Oldfield Engineering Co., Ltd. ... 78

Parnall (Yate), Ltd. 18
Pope's Electric Lamp Co., Ltd.... 26
Premier Cooler and Engrg. Co., Ltd. 72
Premier Electric Heaters, Ltd. 53
Pritchett and Gold and E.P.S. Co., Ltd. 67

Revo Electric Co., Ltd. 25
Reyrolle, A. and Co., Ltd. ... 77
Riley, Robert, Ltd. 86
Rotunda, Ltd. 82
Rowlands Elec. Accessories Ltd. 15

Sanders, Wm. and Co. (Wednesbury), Ltd. 84
Scemco, Ltd. 76
Scholes, George H. and Co., Ltd. 60
Scott, H. J. and Co., Ltd. ... 78
Service Electric Co., Ltd. ... 72
Siemens Bros. and Co., Ltd. ... 3
Sign and Metal Industries Ltd. 16
Simplex Electric Co., Ltd. ... 27
Simon-Carves, Ltd. 79
S.N. Engineering Co., Ltd. ... 82
Sperryn and Co. 56
Standard Tele. and Cables, Ltd. 21
Statter, J. G. and Co., Ltd. ... 80
Steatite and Porcelain Prod., Ltd. 22

Taylor Elec. Instruments, Ltd. ... 58
Tilling-Stevens, Ltd. 56
Timson Bros. (England), Ltd. ... 4
Tucker, J. H. and Co., Ltd. ... 36

U.S. Metallic Packing Co., Ltd. 74

Vacuums, Ltd. 80

Ward, Thos., W. Ltd. 54
Whiteley, B. S. and W., Ltd. ... 29
Wilkes, John, Sons, and Mapplebeck, Ltd. 58

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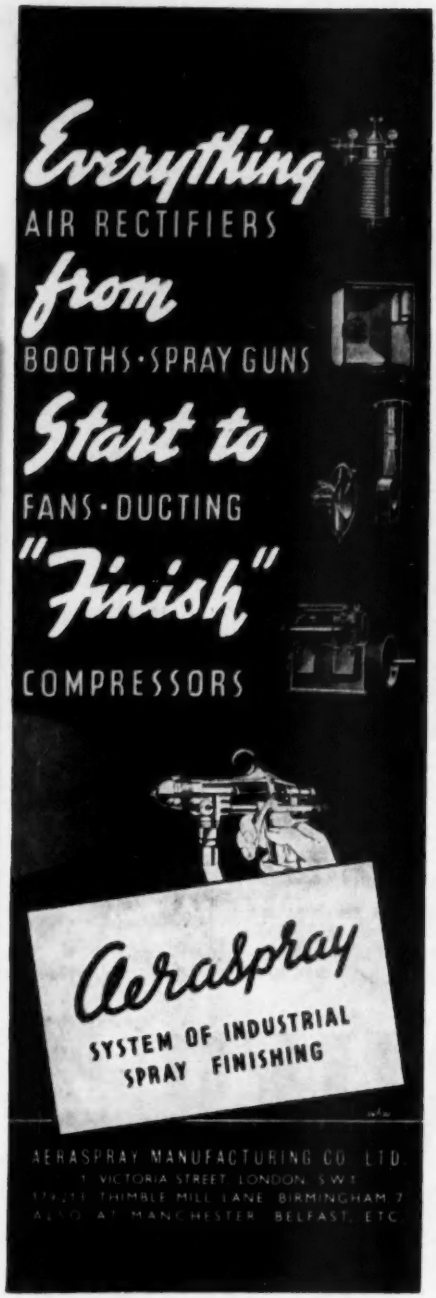

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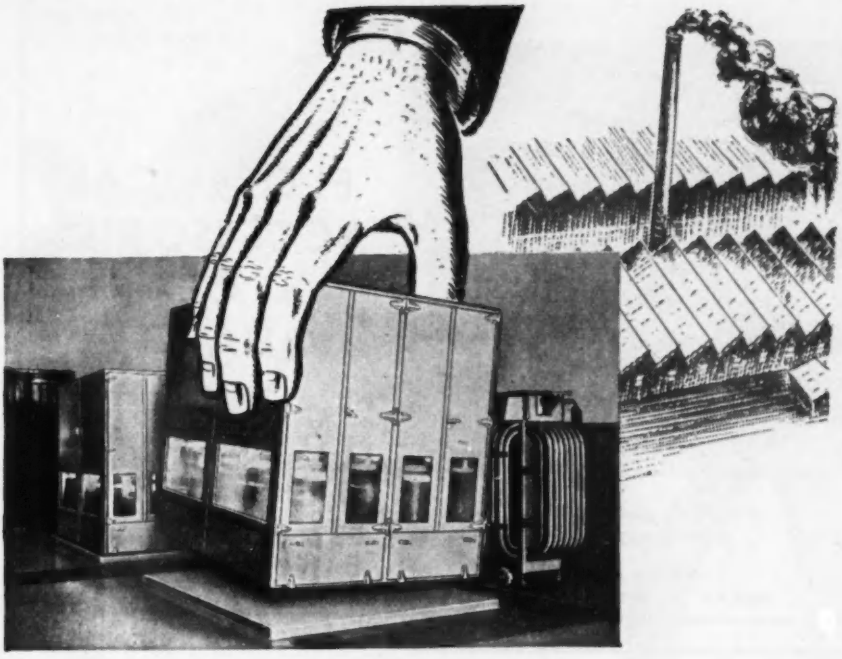

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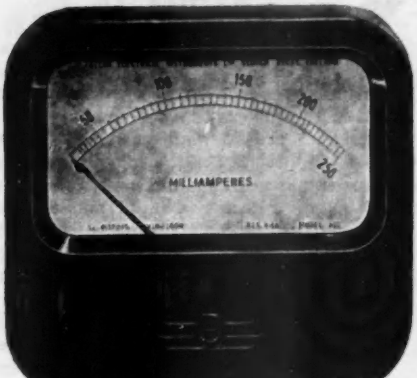

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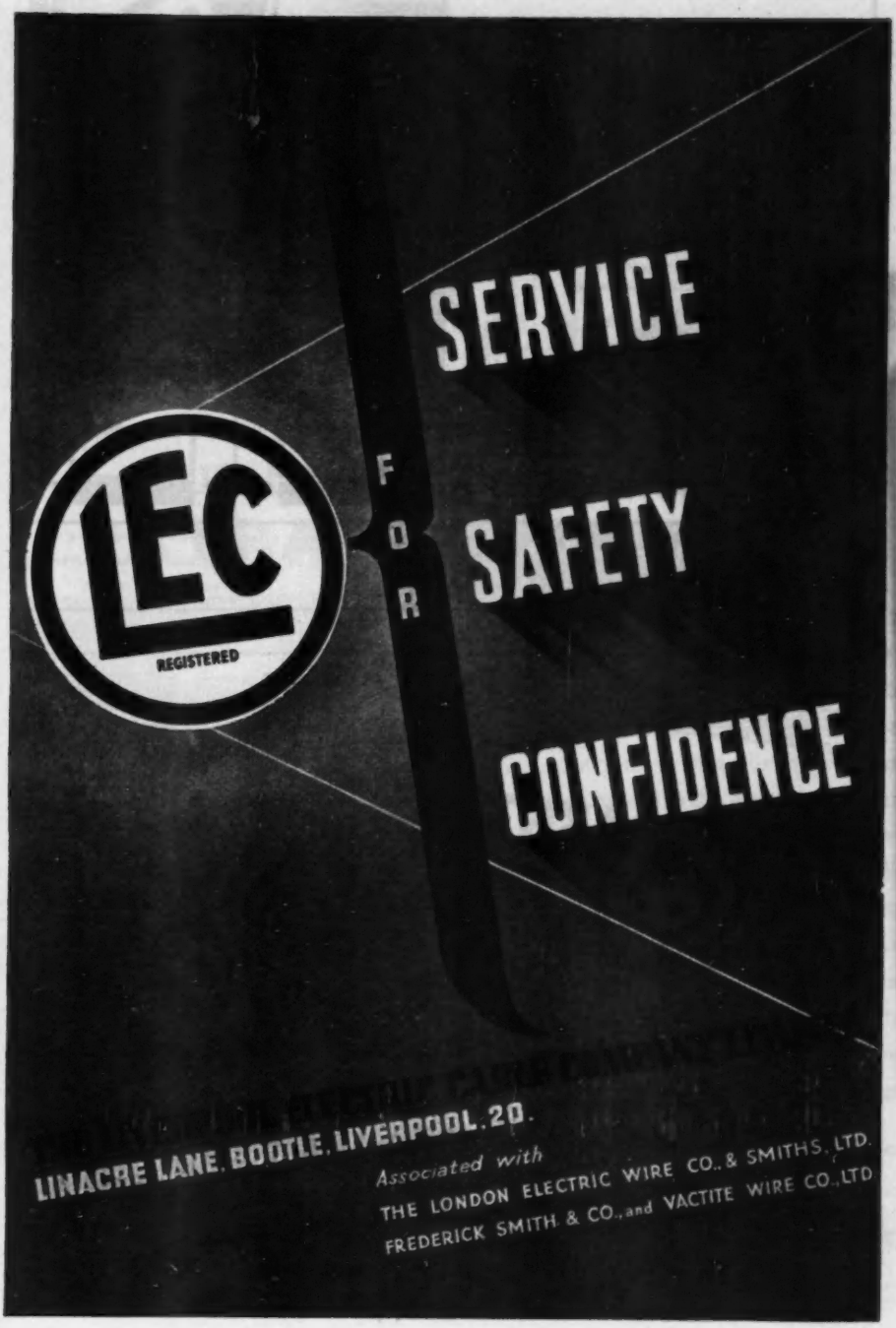
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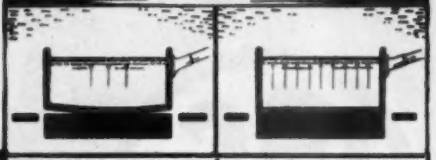

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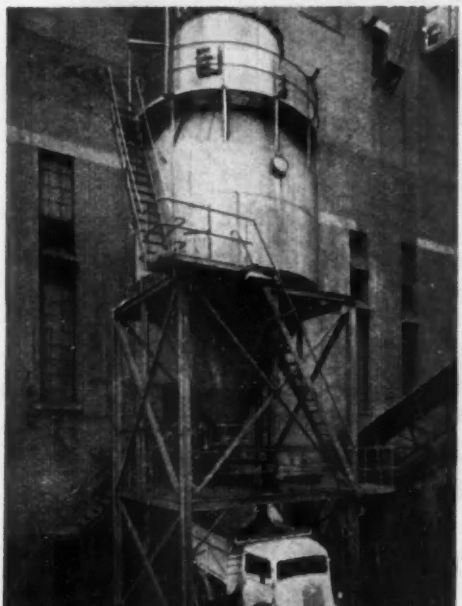

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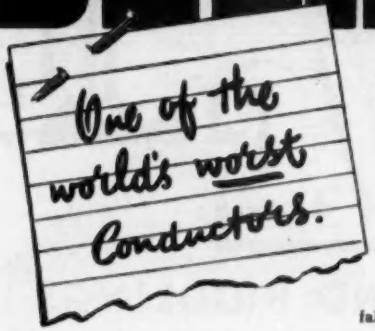

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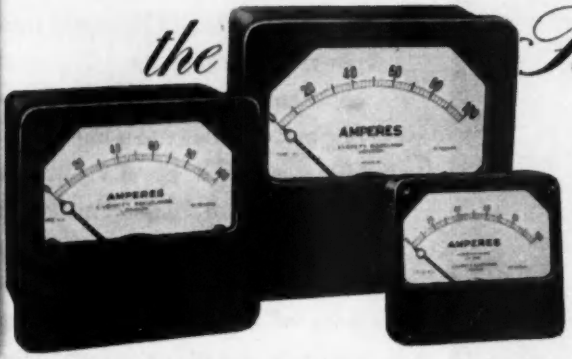

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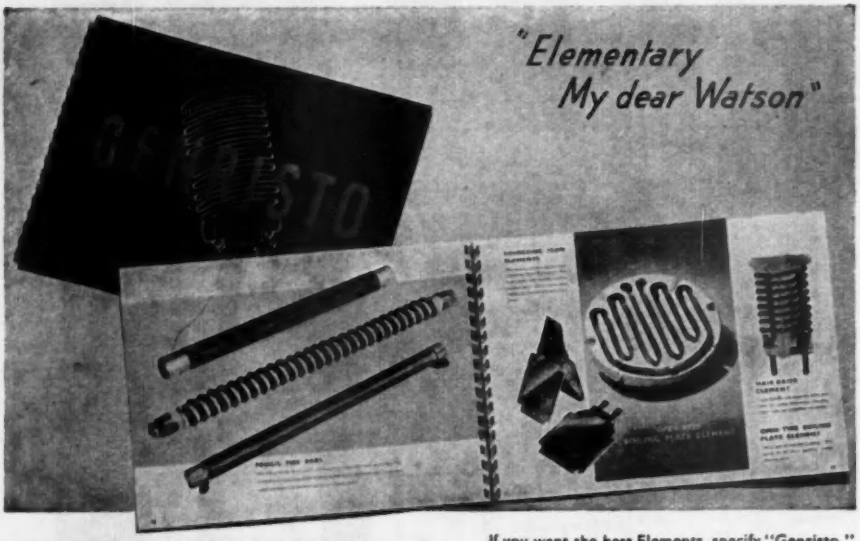

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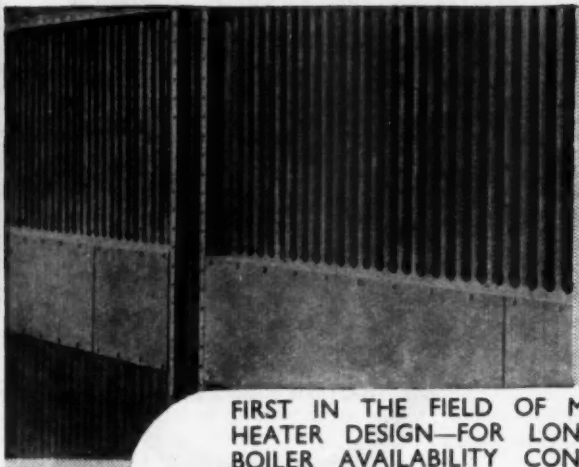

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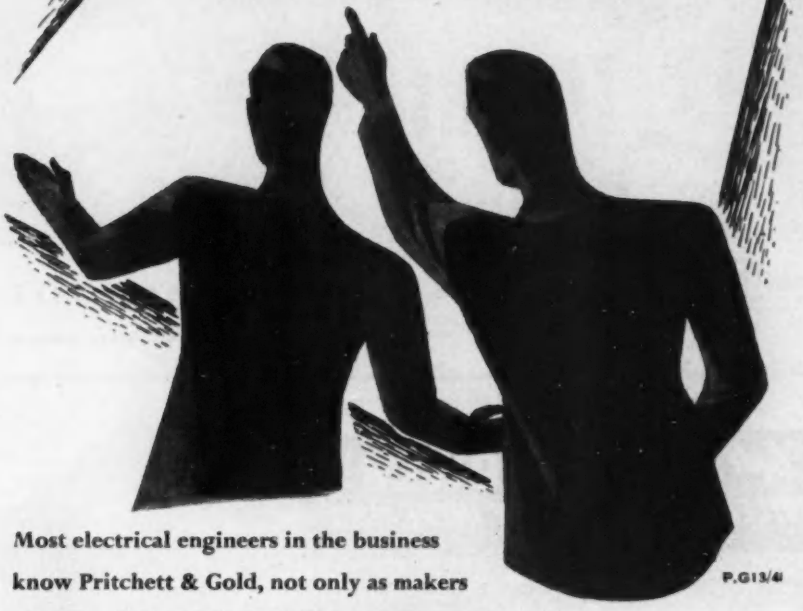

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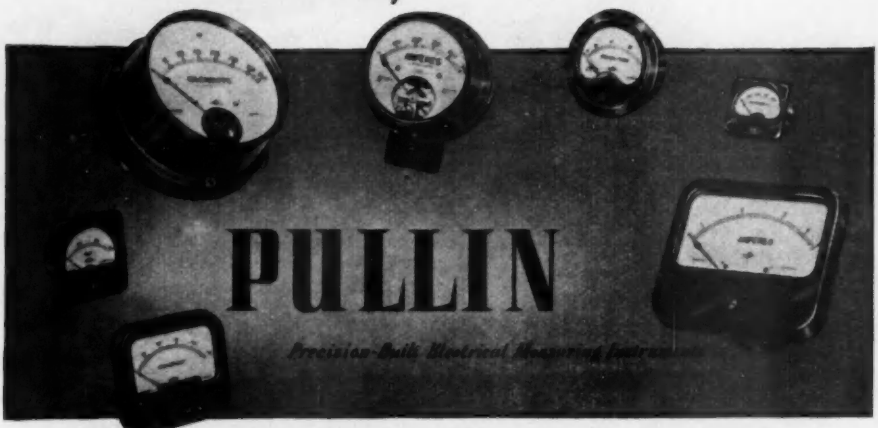

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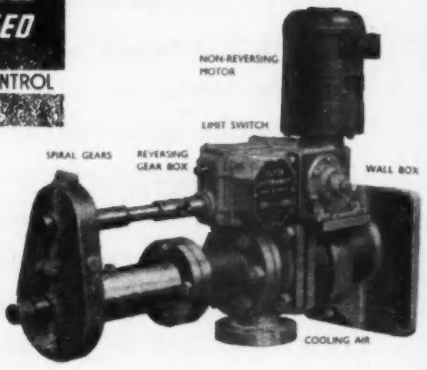

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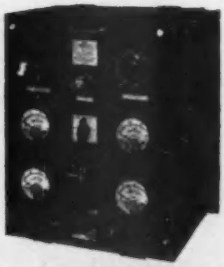

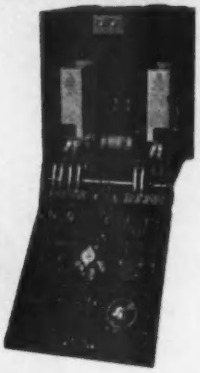

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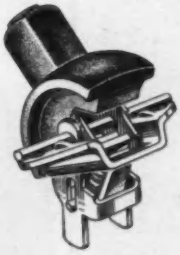

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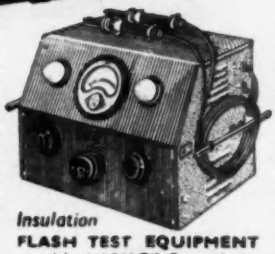

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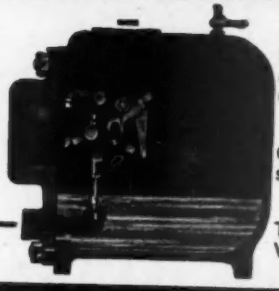

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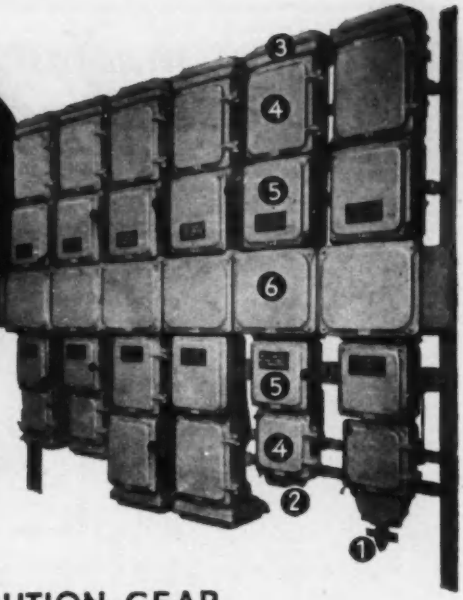
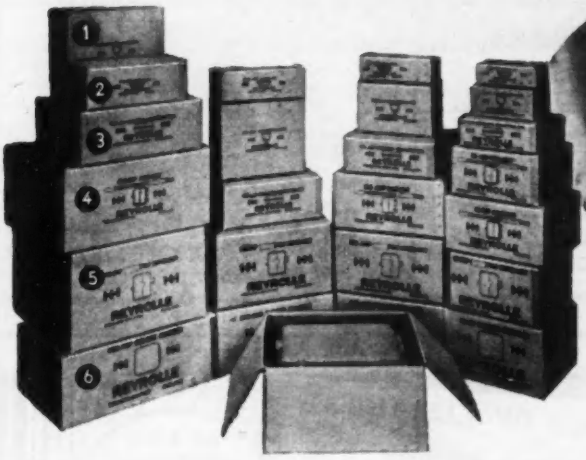


MEDIUM-VOLTAGE DISTRIBUTION-GEAR



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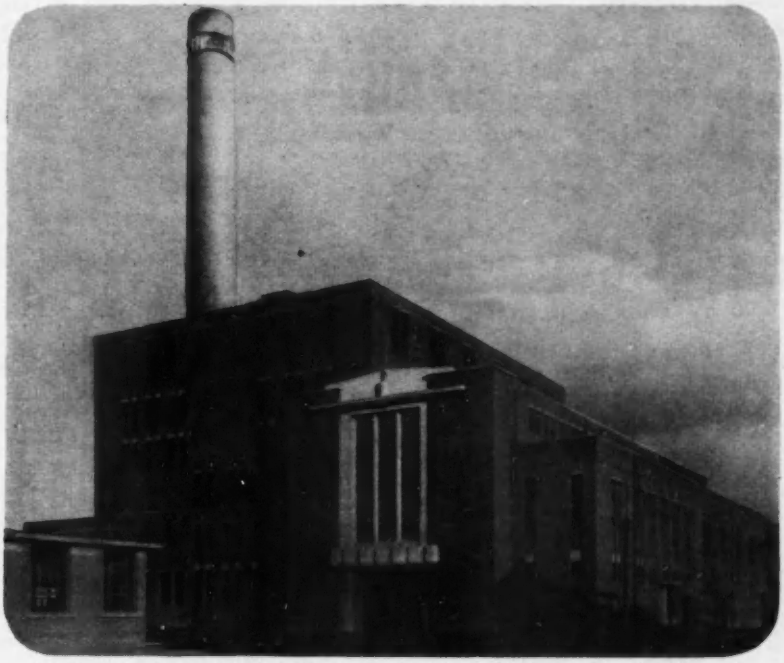

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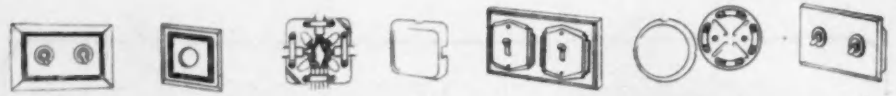
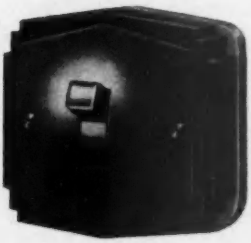


Tenby Pilot Switch



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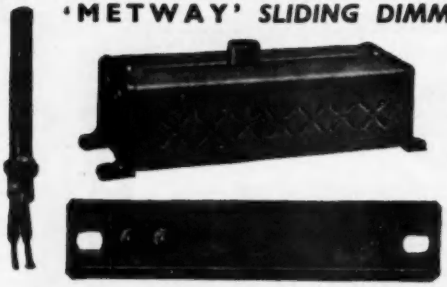

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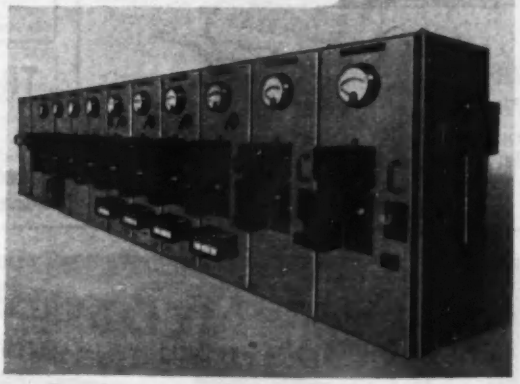
Right: Class AJ21 air-break switchboard supplied to the order of Messrs. Spearing & Co., Ltd., for the Iraq Petroleum Company



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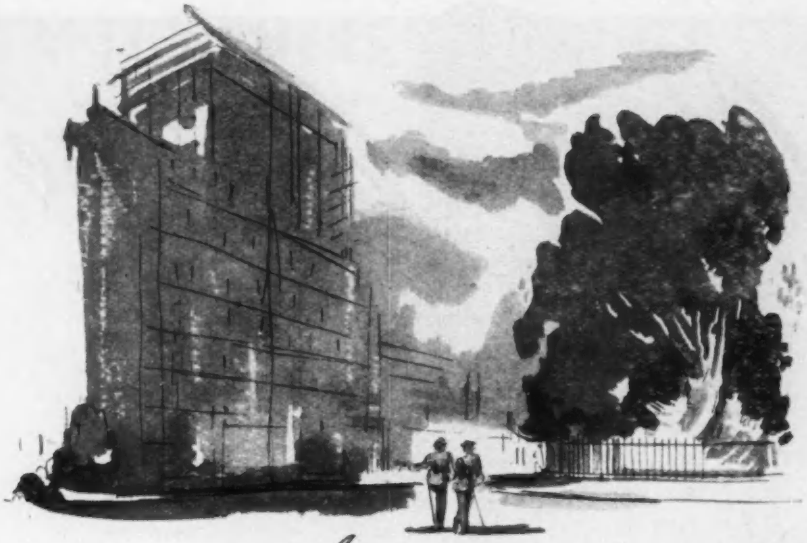

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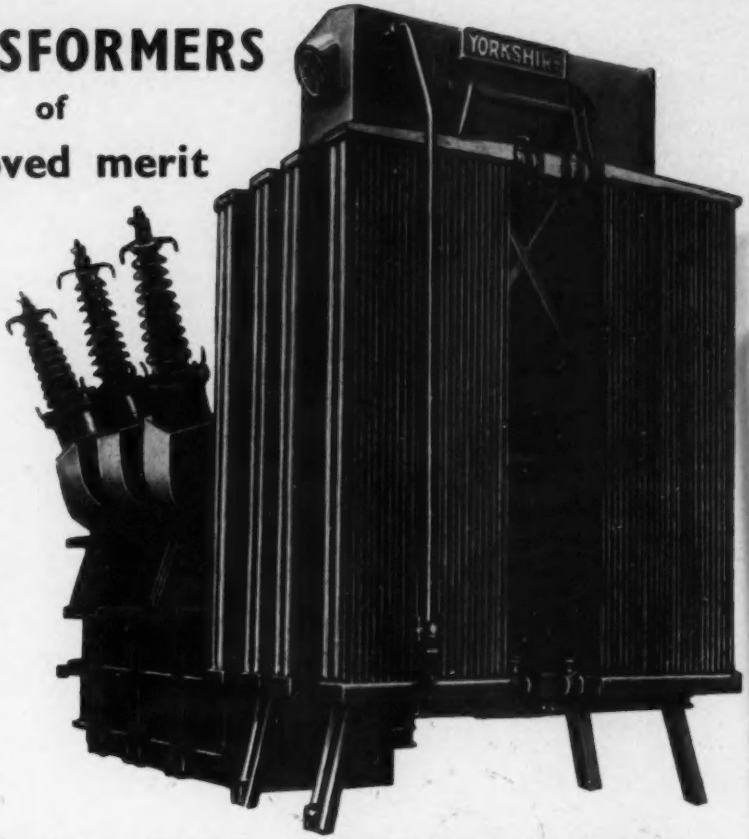

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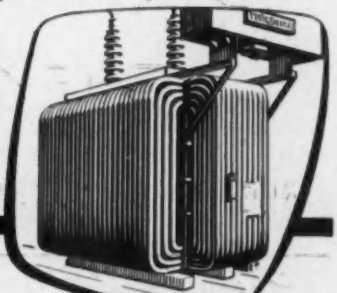

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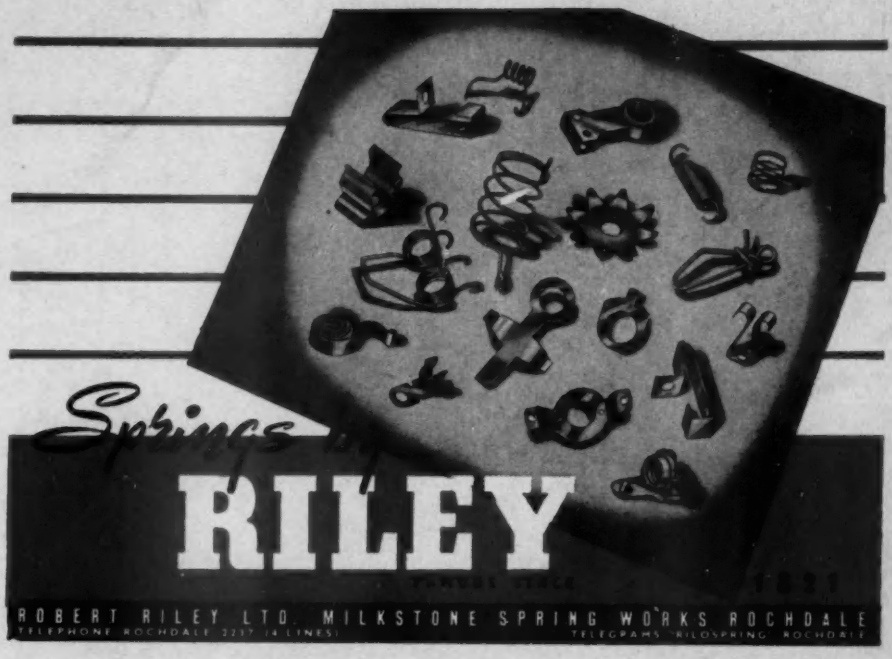

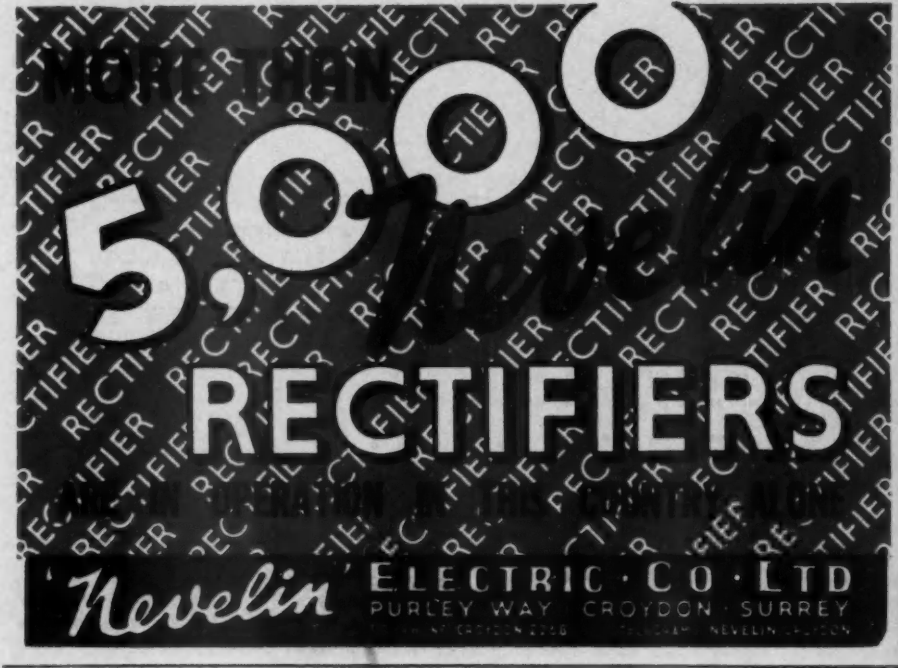

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